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THE CHEIRODONTINÆ, A SUBFAMILY OF MINUTE CHARACID  
FISHES OF SOUTH AMERICA.<sup>1</sup>

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INTRODUCTORY.

The greater part of the work of preparing this monograph was done between January and May, 1915, while enjoying the hospitality of Mr. and Mrs. Carl G. Fisher on their estate at Miami, Florida. President W. L. Bryan and the Trustees of Indiana University appointed me Research Professor for the collegiate year 1914-1915, and the Director of the Carnegie Museum relieved me of resident curatorial duties at the Museum. I thus gained the opportunity under ideal conditions to give my undivided attention to this exceedingly difficult group of fishes. I am indebted, as in former articles, to Dr. W. J. Holland, Director of the Carnegie Museum, for assistance in arranging the figures in the text and on the plates and for his editorial revision of the manuscript. The drawings given on the plates were executed by Mr. Clarence Kennedy of Leland Stanford Jr. University. The drawings given in the text are from camera lucida sketches made by the author.

This paper would naturally form a chapter in my Monograph of the Characidae, to be published by the Museum of Comparative Zoölogy at Cambridge, Mass., but, as the publication of the first volume of the monograph has long been delayed, it is deemed best to publish this article at once.

The material on which this paper is based<sup>2</sup> consists of (a) the collections of

<sup>1</sup> Contributions from the Zoölogical Laboratory of Indiana University, No. 150.

<sup>2</sup> In enumerating the specimens at my disposal I have cited (a) the current numbers in the various museums; (b) the letters a-x, indicating the number of specimens in a given series in the Carnegie Museum; (c) the number of specimens in the particular lot under examination; (d) the size of the largest and sometimes

Harvard University, made chiefly by the Thayer expedition; (b) the collections of Indiana University, made by H. von Ihering in Rio Grande do Sul, by J. D. Anisits in Paraguay, and by Charles Wilson during the Landon-Fisher expedition to Colombia; (c) the collections made under the joint auspices of the Indiana University and the Carnegie Museum on the occasion of the author's expedition to British Guiana, and the reconnaissance undertaken by him in Colombia; and (d) the collections made by Mr. John D. Haseman during the expedition of the Carnegie Museum to central South America. The collections made by Mr. Haseman are by far the largest both in the number of specimens and species. An account of Haseman's travels, together with a list of his localities, was published in the *Annals* of the Carnegie Museum, Vol. VII, p. 287. A map showing his route accompanies the present paper.

There are twenty-one genera and fifty-six species and varieties of Cheirodontinæ now known.<sup>3</sup> In the present paper seven genera and seventeen species for the first time are described. In all I have at one time or another described fourteen genera and thirty-three species. Nineteen of the genera and thirty-nine species are represented in the collections of the Carnegie Museum. In the other museums, so far as known, the species are represented as follows:

|                                                   |    |
|---------------------------------------------------|----|
| Paris (Musée National) . . . . .                  | 1  |
| Vienna (K. K. Hofmuseum) . . . . .                | 8  |
| London (British Museum) . . . . .                 | 9  |
| Genoa (Museo Civico) . . . . .                    | 2  |
| Copenhagen (Zoölogisches Museum) . . . . .        | 1  |
| Cambridge (Mus. Comp. Zoölogy) . . . . .          | 4  |
| New York (Am. Mus. Nat. History) . . . . .        | 1  |
| Washington (U. S. National Museum) . . . . .      | 2  |
| Philadelphia (Acad. Nat. Sciences) . . . . .      | 7  |
| Bloomington (Indiana University Museum) . . . . . | 35 |
| Ithaca, N. Y. (Cornell University) . . . . .      | 1  |

I have examined practically all of the known species except *Cheirodon pisciculus* from western Chili and *Odontostilbe pulchra* from Trinidad. However, while pre- of the smallest specimen; (e) the locality; and (f) frequently the date of collecting and name of the collector. Where the entire series is reserved for the Carnegie Museum the letters after the current number and the number agree. When specimens have been destroyed by dissection or otherwise, or where there are numerous duplicates, the letters and numbers do not necessarily agree.

<sup>3</sup> I have placed the genus *Psolidodon* in the Tetragonopterinæ, although it has the single row of notched teeth characteristic of the Cheirodontinæ. *Psolidodon* and *Henocheilus*, in the latter of which there is a double row of teeth in the upper jaw, form a little group bridging the gap between the Tetragonopterinæ and Cheirodontinæ; or, on account of the absence of lips, they may be regarded as forming a little group distinct from either of the above. *Megalamphodus ecuadorensis*, sp. nov. is described in the Appendix.

paring this revision, I did not have access to specimens of *Aphyocharax avary* Fowler, *Cheirodon eques* Steindachner, *Cheirodon agassizi* Steindachner, *Cheirodon pulcher* = *nattereri* Steindachner, *Odontostilbe drepanon* Fowler, *Odontostilbe madeira* Fowler, and *Leptagoniates steindachneri* Boulenger.

It is quite possible that several of these are here described under other names. It is possible that *C. agassizi* is the male of *Aphyocharax pulcher*, and that *Odontostilbe drepanon* is *Holesthes pequirã*.

#### THE CHEIRODONTINÆ.

The subfamily Cheirodontinæ (*Aphyocharacinæ auctorum*) belongs to the large family Characidae. All the species are small or even minute. The giants of the subfamily are only about 90 mm. long at their best. *Paragoniates alburnus* reaches a length of 90 mm. The largest recorded *Grundulus* is 80 mm. long, the largest *Probolodus* 81, the largest *Parecbasis* 80, the largest *Odontostilbe microcephala* 80. Then follow *Aphyocharax dentatus* with a maximum length of 72 mm., *Cheirodon interruptus* 60 mm., *Aphyocharax alburnus* and *pusillus* 58 mm., *Holesthes pequirã* 56 mm., *H. heterodon* 50 mm., *Prionobrama paraguayensis* 50 mm., and *P. filigerus* 60 mm. The rest are all under 50 mm. in length.

*Generalized type of the subfamily.*—A composite of all the known species will give us an idea of the ancestor of these species, assuming for the moment that they had a common ancestor, which is open to some doubt. However, even if a few of the genera included do not belong to this an otherwise homogeneous group, they are so nearly like them that their inclusion will scarcely impair the full value of the generalized type.

The generalized type is a fish rather under fifty millimeters, or two inches, in length; compressed, oval, with symmetric dorsal and ventral outlines. Its depth at the origin of the dorsal is about one-third of the length from the tip of the snout to the end of the median series of scales. The head is about equal to one-fourth of this length. The eye is large, about one-third as long as the head. The mouth is terminal and the maxillary reaches to about the origin of the eye. The cheeks and postorbital portion of the head are protected by the well-developed chain of suborbital bones, of which the third is in contact with the lower limb of the preopercle, there being a naked wedge between it and the vertical limb of the preopercle. The teeth are in a single series, comparatively few in number, and with lateral notches. They occur along the entire edge of the premaxillary, at the upper angle of the maxillary, and along the front and sides of the lower jaw. The



teeth of the maxillary are similar to those of the premaxillary and the lateral teeth of the mandible are always smaller than those near the front. A frontal and a parietal fontanel are present, the latter being the larger, truncated in front; the former is triangular, the base of the triangle being caudad. The occipital crest is narrowly triangular and divides the scales of the two sides for a distance of about one-fourth of the length from its base to the dorsal. The dorsal is short, pointed, consisting of one rudimentary and ten developed rays; having its origin midway between the tip of the snout and the base of the middle caudal rays. The adipose is a small free lobe as in the greater number of all the characid fishes, and is placed over the end of the anal. The caudal is deeply forked. The anal is emarginate, having its origin under the last dorsal ray, and it consists of twenty-five rays. The ventrals are placed slightly in front of the origin of the dorsal and they do not quite reach the anal. The pectorals are lanceolate and do not quite reach the origin of the ventrals. The scales are thin, very regularly arranged. The fins are naked except for a few scales along the base of the anterior anal rays. There is a well-developed axillary scale over the ventrals. There are thirty-five scales along a median series, eight of which have lateral line pores. There is a dark spot on the sides from about the third to the fifth scales of the lateral line, and another larger spot on the end of the caudal peduncle and the base of the caudal. In a triangular area over the sides of the anterior air-bladder the wall of the body consists of skin and peritoneum only.

*Minor deviations from the generalized type.*—The deviations from this general type are numerous, but not very great. The greatest deviations are found in the size of the frontal fontanel; the armature of the cheek, especially the postorbital portion of it; the length of the anal; the degree of the development of the pseudotympanum; and especially the size of the mouth and its parts and the style of the teeth. Leaving these to be considered last, we find some of the species (*Aphyocharax*) are much less compressed than others, and in these the depth is frequently less than one-third of the length, the minimum depth being contained about four times in the length in a number of species of *Aphyocharax*. In the deepest the depth is contained but 2.4 times in the length (*Megalomphodus megalopterus*). The head varies from 3.3–4.66 in the length in different species. It is comparatively shortest in *Paragoniates paraguayensis* and comparatively longest in *Spintherobolus*. The eye is always large. In different species it is contained from 2.3–4.33 in the length of the head, but in only two forms, *Grundulus* and *Spintherobolus* is it contained as many as 3.75 times. In the great majority of cases it is contained 2.5–3 times. The adipose fin is absent in *Grundulus* and *Spintherobolus*, which otherwise

do not differ greatly from the other species. The caudal lobes may be a little longer or shorter, a little more pointed or rounded, and there may be more or less difference between the upper and lower lobes, but there is no striking deviation from the type. The ventrals and pectorals may be a little longer or shorter, but here again there is no great divergence from the central type. The scales differ materially. The lateral line may be developed on but two scales, or it may be complete. It is complete in *Probolodus*, *Parecbasis*, *Holesthes*, and *Odontostilbe*. It is almost complete in *Microchemobrycon*. In the other genera it is developed on less than fifteen scales, the exact number varying with the species. In *Grundulus* the predorsal scales have disappeared; in *Aphyodite* the caudal has become mostly covered with small adherent scales, and in *Compsura* and *Odontostilbe hastata* the male is provided with a few enlarged scales on the caudal which recall the Glandulocaudinæ. The degree of the development of the pseudotympanum differs greatly, the humeral region being apparently normal in a number of species. It is most highly developed in *Holesthes*, *Odontostilbe*, *Megalamphodus*, and the deeper species of *Cheirodon*. In color (alcoholic, which means the distribution of melanophores only) the species of this subfamily do not differ greatly from species of *Hemigrammus* and *Hyphessobrycon* of the Tetragonopterinae. In many species of the Tetragonopterinae and other subfamilies some sort of a spot occurs on the sides, a little behind the origin of the lateral line. This spot is found in over half of the species with tricuspid teeth. In the species with multicuspid teeth it occurs only in *Mixobrycon*. A caudal spot at the end of the caudal peduncle and on the base of the caudal has an even wider distribution among the Characins in general. Among the Cheirodontinae it is all but uniformly found in the species with multicuspid teeth, i. e., in those species in which the humeral spot is not developed. Other markings are some sort of a spot on the dorsal, which occurs in six species belonging to four genera. It is therefore not a sign of relationship. Similar spots occur on some of the smallest Tetragonopterids. Another marking which occurs sporadically in several species is a dark band along the tips of the short anal rays and across the lobe of the anal.

*Deviations from the generalized type on which the genera are based.*—The frontal fontanel may be small, having the form of an equilateral triangle, and may form only a wedge between the posterior part of the frontals (it has nearly reached the vanishing point in *Aphyocheirodon*) or it may, as in *Megalamphodus*, be of nearly uniform width and entirely separate the frontals.

In all but three genera, *Grundulus*, *Spintherobolus*, and *Mixobrycon*, the second suborbital is in contact with the opercle below. In both *Grundulus* and

*Spintherobolus* the suborbitals are feeble, very different from those in the other genera. In *Microbrycon* there is a naked area around the entire distal edge of the third suborbital, similar to that in most of the Tetragonopterinae. The greatest difference in the armature of the cheeks occurs in the postorbital region. In *Aphyocharax* there are two postorbitals. Of these the upper is minute and negligible, the lower is large, convex, similar to the third suborbital, and covers the entire postorbital area. *Prionobrama* has a similar arrangement. In other genera there are three or more postorbitals and there is a wider or narrower naked area between them and the vertical limb of the preopercle. In one genus, *Aphyocheiroidon*, there is considerable individual variation in the number and size of the postorbitals.

*Anal fin.*—The anal varies. In *Cheiroidon annæ* the base is very short, entirely behind the dorsal, the margin is rounded, and the highest rays extend beyond the tip of the last. In *Paragoniates*, *Leptagoniates*, and *Phanagoniates* the base is very long, having its origin below the first dorsal ray or far in front of it. In *Prionobrama* its margin is extremely falcate. Between these extremes there are various modifications, the rays varying from twelve in *Spintherobolus*, fourteen in *Leptobrycon*, *Cheiroidon annæ*, and *Cheiroidon pisciculus*, to fifty in *Paragoniates alburnus*, and seventy in *Leptagoniates*. In the great majority of species the number of rays ranges between twenty and twenty-six. In the genus *Cheiroidon*, the species of which fall into two groups, the greatest range is from twelve to twenty-seven. In *C. pisciculus* and *C. annæ* the number of rays ranges from twelve to fifteen; and in the nine other species from seventeen to twenty-seven. In seventy-nine specimens of one species, *Cheiroidon interruptus*, the number of anal rays is as follows:

|                        |     |     |     |     |     |     |     |    |
|------------------------|-----|-----|-----|-----|-----|-----|-----|----|
| Number of rays:        | 17, | 18, | 19, | 20, | 21, | 22, | 23, | 24 |
| Number of individuals: | 2   | 6   | 28  | 16  | 12  | 11  | 3   | 1  |

These are from several distinct localities, and the extremes have not been observed in specimens from one locality.

*Dorsal fin.*—The variation of the dorsal is not nearly as great as that of the anal, and therefore of less taxonomic importance. Usually its origin is a little behind or in front of the middle of the body, the distance in either direction being negligible, but in *Grundulus* and in *Prionobrama*, *Paragoniates*, *Leptagoniates*, and *Phanagoniates* it is distinctly behind the middle. Its outline may be rounded, obliquely truncate, or it may be distinctly falcate as in *Parecbasis*. It reaches its extreme development in *Megalampodus megalopterus*.

*Mouth.*—The greatest evolution in this group, as in the rest of the Characins, has taken place in the mouth and teeth. The mouth ranges in size from such a minute affair as is found in *Oligobrycon microstomus*, *Compsura heterura*, *Cheiroidon*

*notomelas*, and *C. piaba*, to the elupcoid openings in *Leptobrycon jatuaranæ*, *Macropsobrycon uruguayana*, *Megalamphodus megalopterus*, and *M. micropterus*. But the size of the mouth in itself is of no great importance, for there is great variation within such genera as *Aphyocharax* and *Cheirodon*. There is very great difference in the size and shape of the premaxillary and maxillary, as the outlines in the text-figures show.

*Teeth.*—The greatest interest centers in the teeth. In *Grundulus* all of the teeth are peg-like, conical, single-pointed. Such teeth frequently appear on the sides of the lower jaw, when the teeth are otherwise very different. They are also frequently found on the distal part of the maxillary, when the number of teeth on this bone are considerable, and they are also found in the premaxillary when the teeth are feeble or numerous. The next degree of complexity is found in the three-pointed teeth in the genera *Spintherobolus*, *Probolodus*, *Aphyocharax*, *Macropsobrycon*, *Microschemobrycon*, and *Oligobrycon*. In *Aphyocheirodon* there are three- to five-pointed teeth in the upper jaw and five-pointed teeth in the lower jaw. In the remaining genera the teeth have typically five or more points. Frequently the teeth in the sides of the lower jaw are not only smaller, but belong to a lower order, *i. e.*, they have fewer points than the others in the same mouth. The same may be true, but to a less extent, of the teeth on the outer part of the premaxillary and on the distal part of the maxillary. Usually the number of teeth in any bone differs inversely as the number of points to each tooth, though this is not always the case. In the species with many-pointed teeth the number of teeth is usually very limited, none to three in the maxillary of *Cheirodon*, none to four in *Odontostilbe*, but in one species of that genus ranging from four to seven. However, several of the genera with tricuspid teeth have no teeth on the maxillary, others have as many as twenty or more.

To say that the teeth are unicuspid, tricuspid, or multicuspid, does not tell the whole story. There have evidently been divergent radiations within each of these groups both in the shape of the individual teeth and in their arrangement. These teeth are so difficult to observe, even with the aid of the modern binocular microscope and a spot-light, that in all cases where I had material the individual bones were dissected out and mounted in balsam. Camera-lucida sketches were then made. Under all the circumstances I think it will be best to entirely ignore statements about the teeth in the older descriptions, whether made by myself or by others. Statements that the entire edge of the maxillary is denticulate and that there are no teeth in the maxillary are especially to be doubted.

Reverting to the modifications of the three types of teeth, unicuspid, tricuspid,



and multicuspid, it may be observed that the conic tooth may be a simple cone, but is much more likely to be recurved. All the teeth of *Grundulus* are of this type. Part of the teeth on the maxillaries of the genera with tricuspid teeth are also unicuspid, and probably by degeneration some of those on the premaxillary. The tricuspid type varies from a slender conic tooth with a minute notch on each side to a tooth in which the three points are of about equal size, nearly coterminous, and arranged in a line, to a heavy tooth with a blunt central point and two minute lateral points, so arranged that the three points mark the angles of a triangle (*Probolodus*). The five- to nine-pointed teeth may have a large central cusp and two graduate cusps on the sides of the tooth, the line connecting the five (or more points) forming parts of an ellipse, or the points may be of nearly equal value and nearly coterminous. Between these there are many shades, several variations not infrequently occurring in different parts of the same jaw. A very distinct type of tooth as well as arrangement is found in the lower jaw of *Aphyocheirodon*. The teeth in this jaw are usually five-pointed. The three middle points are of about equal size and subtruncate, so that their tips form chisels rather than points. The outer cusps are very minute and so far withdrawn from the level of the rest that they are easily overlooked. That this surprising shape is not the result of wear is shown by the relay-teeth which have the same shape as the rest. With all these modifications the sides of the multicuspid teeth may be parallel or very much contracted basally. The teeth are usually quite flat, or rather thin, but in *Mixobrycon* the teeth are heavy and approach the shape of the teeth of the Tetraodonopterinæ. In all but one species the teeth are strictly uniserial. In *Megalamphodus micropterus* one of the teeth of the premaxillary is sometimes out of line with the rest, a little further forward, and forms either an incipient or a reminiscent anterior series.

The number of teeth as well as the shape of the teeth described above indicate that the dentition of this group of the Characins is highly specialized. In this character of high specialization they are not unique among the Characins, for it is in the shape, number, and arrangement of the teeth that the greatest divergence has taken place.

The number of teeth on the premaxillary and the frequency of the appearance of any given number is indicated in the following table:

|                                                     |    |    |    |    |    |    |    |     |     |     |     |    |
|-----------------------------------------------------|----|----|----|----|----|----|----|-----|-----|-----|-----|----|
| Number of teeth in premaxillary:                    | 3, | 4, | 5, | 6, | 7, | 8, | 9, | 10, | 11, | 12, | 13, | 14 |
| Number of species having the given number of teeth: | 1  | 7  | 11 | 10 | 14 | 9  | 6  | 5   | 2   | 2   | 1   | 2  |

In this table seventeen species occur in more than one count; to be exact, five species occur in two counts, ten in three, one in four, and one in five. In other

words, in five species there may be a deviation of one tooth from the normal, in ten species there may be a deviation of as many as three teeth (*Aphyocharax* seven to ten), and in one (*Odontostilbe melandeta*) there may be a deviation of as many as



FIG. 1. Types of teeth and their variations in the Cheirodontinæ. *a*, mandibular tooth of *Grundulus*; *b* and *b'*, premaxillary teeth of *Macropsobrycon*; *c-c²*, premaxillary teeth of *Aphyocharax anisitsi*, *c*, the symphyseal tooth, *c¹*, the second, and *c²*, the third tooth from it; *d*, mandibular tooth of *Megalomphodus megalopterus*; *e*, mandibular tooth of *Spintherobolus*; *f* and *f'*, a mandibular and premaxillary tooth of *Parecbasis*; *g* and *g'*, a maxillary and premaxillary tooth of *Prionobrama*; *h-h⁷*, entire set of mandibular teeth of an *Oligobrycon microstomus*; *i-i⁸*, entire set of premaxillary teeth of a *Megalomphodus micropterus*, *i* and *i¹*, the usual type, *i⁴*, with incipient cusps on the sides of the median cusp; *j-j⁷*, entire set of premaxillary teeth of an *Aphyocheiroidon*; *j⁸* and *j⁹*, active mandibular teeth of an *Aphyocheiroidon*; *j¹⁰*, relay tooth, which has not pierced the gum of an *Aphyocheiroidon*; *k, k¹, k², k³*, a mandibular tooth, a premaxillary tooth, and two maxillary teeth of *Compsoura heterura*; *l-l¹*, a premaxillary and a maxillary tooth of a *Cheirodon piaba*.

four teeth. But of this latter species I have but few specimens, unsatisfactorily preserved, and the result is doubtful. The larger number of the species have seven premaxillary teeth. The number of species having six or eight teeth are nearly equally matched. It must be borne in mind that the number of specimens examined has not been so great that we can be sure that all variations have been observed.

The maxillary teeth recorded are as follows:

|                    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |    |
|--------------------|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| Number of teeth:   | 0, | 1, | 2, | 3, | 4, | 5, | 6, | 7, | 8, | 9, | 10, | 11, | 12, | 13, | 14, | 15, | 16, | 17, | 18, | 19, | 20 |
| Number of species: | 4  | 7  | 19 | 10 | 7  | 5  | 5  | 2  | 1  | 1  | 3   | 2   | 4   | 4   | 3   | 2   | 2   | 1   | 1   | 1   | 3  |

Four of the species occur in two counts, six occur in three, four in four, one in five, one in seven, and one in twelve (from nine to twenty in *Aphyocharax dentatus*). The prevailing number is two teeth, which are found in nineteen species, as shown by the table; which also shows that the number of species having from twelve to fourteen and twenty teeth is relatively greater than those having from seven to eleven, and from fifteen to nineteen teeth.

#### THE RELATIONSHIP OF THE CHEIRODONTINÆ.

Are the Cheirodontinæ a homogeneous group with a common ancestry, or are they dwarfs of various other subfamilies? The most of them form a homogeneous group, divisible, however, into a number of minor groups. Doubt arises as to *Grundulus*, which has only conic teeth, *Paragoniates*, *Leptagoniates*, and *Phanagoniates* with a posterior dorsal, and *Mixobrycon*, which has tetragonopterid teeth and cheeks. Certain other characters, notably the peculiar scaling in the caudal of the males of *Compsura* and *Odontostilbe hastata*, also suggest relationship to another subfamily, the Glandulocaudinæ.

The unicuspid teeth of *Grundulus* suggest relationship with the Characinæ, as some of the Characinæ with partially tricuspid teeth, *Oligosargus exodon*, and *Bramocharax* suggest relationship with the Cheirodontinæ. The general shape and backward position of the dorsal of *Paragoniates* as well as the peculiar scales in the tail of the male *Compsura* and *Odontostilbe* recall the Glandulocaudinæ. The heavy teeth and armature of the cheeks of *Mixobrycon* suggest *Hyphessobrycon* of the Tetragonopterinae and so does the tooth out of line with the rest in *Megalampodus micropterus*. However, a double row of teeth has several times been evolved in the Characinæ from a single row; or a single row from a double row. I have pointed out such cases in Indiana University Studies No. 20, and will have occasion to point out others in the monographs on the Chalepininæ and Gasteropelicinae. In fact if it were not for other considerations, the single series of teeth in the Cheirodontinæ would be no more sufficient to segregate them from the Tetragonopterinae

than would the completeness or incompleteness of the lateral line justify the collocation of the genera having these characters in subfamilies.

In the peculiar armature of the cheeks *Prionobrama* shows such similarity to *Aphyocharax* that Cope placed it in the latter genus. In spite of its general appearance and the backward position of the dorsal, *Prionobrama* is probably more nearly related to *Aphyocharax* than to any member of the Glandulocaudinæ.

The peculiar scaling of the caudal in two of the species recalls the similar character in the Glandulocaudinæ and in *Argopleura* of the Tetragonopterinae. It is possible that this is also an independently acquired character in a number of remotely related genera.

While it is very probable that we are dealing with a natural group, it is certain that different members point to three distinct subfamilies from which they may have been derived, or to which they may have given rise. The Cheirodontinæ are certainly near the generalized type of all the Characins.

#### SECONDARY SEXUAL DIFFERENCES.

There are no conspicuous secondary sexual differences in the group under consideration, unless there should be a striking difference in the lipochromes, which have been dissolved in alcohol.

The differences when present consist in the length of the fin-rays, in the filamentous termination of the fins, in the development of hooks on the anal, and less frequently on the caudals and ventrals of the male, in the development of scaly pockets on the caudal of the males, in the color of the dorsal, and, what is unique for this group, in the high development of the interhæmals in the male in *Cheirodon*. The details are given under the respective species.

#### DISTRIBUTION.

The Cheirodontinæ apparently reach their maximum development in the middle Amazon and the upper La Plata basins. It is quite possible that this greater abundance in the middle Amazon and in the Paraguay basin is apparent rather than real. Little collecting has been done with fine meshed nets in the Orinoco and in the upper waters of the Amazon.

The group as a whole has a very wide distribution. The genus *Cheirodon* has a range all but coextensive with that of the subfamily. The species, with the exception of *Cheirodon piaba* Lütken, are confined to rather limited ranges. Only two species are found both in the Paraguay and in the Rio Guaporé. A number of species in the Madeira and Paraguay are evidently very closely related.



TABLE OF THE DISTRIBUTION OF THE SPECIES OF THE CHEIRODONTINÆ.

|                                                             | Atlantic Slope, Colombia, Panama. | British Guiana. | Orinoco, Trinidad. | Amazon. | Madeira. | Paraguay. | La Plata, Uruguay. | Paraná. | R. Grande do Sul. | Coastal Streams, R. Dece to R. Grande do Sul. | Rio S. Francisco. | R. Iapicard. | Plains, Bogotá and Santander, Colombia. | Western Chile. |
|-------------------------------------------------------------|-----------------------------------|-----------------|--------------------|---------|----------|-----------|--------------------|---------|-------------------|-----------------------------------------------|-------------------|--------------|-----------------------------------------|----------------|
| 1. <i>Grundulus bogotensis</i> (Humboldt).....              |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         | ×              |
| 2. <i>Spintherobolus papilliferus</i> Eigenmann .....       |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 3. <i>Probolodus heterostomus</i> Eigenmann .....           |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 4. <i>Aphyocharax dentatus</i> Eigenmann & Kennedy.....     |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 5. <i>Aphyocharax alburnus</i> (Günther).....               |                                   |                 |                    | ×       | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 6. <i>Aphyocharax erythrurus</i> Eigenmann.....             |                                   | ×               |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 7. <i>Aphyocharax pusillus</i> Günther.....                 |                                   |                 |                    | ×       | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 8. <i>Aphyocharax anisitsi</i> Eigenmann & Kennedy.....     |                                   |                 |                    |         |          | ×         | ×                  |         |                   |                                               |                   |              |                                         |                |
| 9. <i>Aphyocharax awary</i> Fowler.....                     |                                   |                 |                    |         | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 10. <i>Aphyocharax rathbuni</i> Eigenmann.....              |                                   |                 |                    |         | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 11. <i>Aphyocharax paraguayensis</i> Eigenmann.....         |                                   |                 |                    |         | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 12. <i>Aphyocharax nattereri</i> (Steindachner).....        |                                   |                 |                    | ×       | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 13. <i>Aphyocharax agassizi</i> (Steindachner).....         |                                   |                 |                    | ×       | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 14. <i>Aphyocharax maxillaris</i> Ulrey.....                |                                   |                 |                    | ?       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 15. <i>Paragoniates alburnus</i> Steindachner.....          |                                   |                 |                    | ×       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 16. <i>Prionobrama paraguayensis</i> (Eigenmann).....       |                                   |                 |                    |         |          | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 17. <i>Prionobrama filigerus</i> (Cope).....                |                                   |                 |                    | ×       | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 18. <i>Leptagoniates steindachneri</i> Boulenger.....       |                                   |                 |                    | ×       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 19. <i>Phanagoniates wilsoni</i> Eigenmann.....             | ×                                 |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 20. <i>Parcebasis cyclolepis</i> Eigenmann.....             |                                   |                 |                    |         | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 21. <i>Leptobrycon jatuaranæ</i> Eigenmann.....             |                                   |                 |                    | ×       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 22. <i>Aphyodite grammica</i> Eigenmann.....                |                                   | ×               |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 23. <i>Macropsobrycon uruguayanae</i> Eigenmann.....        |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 24. <i>Megalamphodus megalopterus</i> Eigenmann.....        |                                   |                 |                    |         |          | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 25. <i>Megalamphodus eques</i> (Steindachner).....          |                                   |                 |                    | ×       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 26. <i>Megalamphodus melanotus</i> Eigenmann.....           |                                   | ×               |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 27. <i>Megalamphodus heterosthes</i> (Ulrey).....           |                                   |                 |                    | ×       |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 28. <i>Megalamphodus micropterus</i> Eigenmann.....         |                                   |                 |                    |         |          |           |                    |         |                   |                                               | ×                 |              |                                         |                |
| 29. <i>Microschemobrycon guaporensis</i> Eigenmann.....     |                                   |                 |                    |         | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 30. <i>Oligobrycon microstomus</i> Eigenmann.....           |                                   |                 |                    |         |          |           |                    |         |                   | ×                                             |                   |              |                                         |                |
| 31. <i>Aphyochetodon hemigrammus</i> Eigenmann.....         |                                   |                 |                    |         |          |           |                    | ×       |                   |                                               |                   |              |                                         |                |
| 32. <i>Compsura heterura</i> Eigenmann.....                 |                                   |                 |                    |         |          |           |                    |         |                   |                                               | ×                 | ×            |                                         |                |
| 33. <i>Microbrycon ribeiroi</i> (Eigenmann).....            |                                   |                 |                    |         |          | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 34. <i>Cheirodon pisciculus</i> Girard.....                 |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         | ×              |
| 35. <i>Cheirodon annæ</i> MeAtee. <sup>1</sup> .....        |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 36. <i>Cheirodon insignis</i> Steindachner.....             | ×                                 |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 37. <i>Cheirodon paraguayæ</i> Eigenmann.....               |                                   |                 |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 38. <i>Cheirodon interruptus</i> (Jenyns).....              |                                   |                 |                    |         |          |           | ×                  |         |                   |                                               |                   |              |                                         |                |
| 39. <i>Cheirodon monodon</i> Cope.....                      |                                   |                 |                    |         |          |           |                    | ×       |                   |                                               |                   |              |                                         |                |
| 40. <i>Cheirodon ibicuijensis</i> Eigenmann.....            |                                   |                 |                    |         |          |           | ×                  |         |                   |                                               |                   |              |                                         |                |
| 41. <i>Cheirodon notomelas</i> Eigenmann.....               |                                   |                 |                    |         |          |           |                    | ×       |                   |                                               |                   |              |                                         |                |
| 42. <i>Cheirodon madeiræ</i> Eigenmann.....                 |                                   |                 |                    |         | ×        |           |                    |         | ×                 |                                               |                   |              |                                         |                |
| 43. <i>Cheirodon piaba</i> Lütken.....                      |                                   |                 |                    |         | ×        | ×         | ×                  |         | ×                 |                                               | ×                 |              |                                         |                |
| 44. <i>Cheirodon microdon</i> Eigenmann.....                |                                   |                 |                    |         |          | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 45. <i>Cheirodon stenodon</i> Eigenmann.....                |                                   |                 |                    |         |          |           |                    | ×       |                   |                                               |                   |              |                                         |                |
| 46. <i>Holesthes pequirã</i> (Natterer).....                |                                   |                 |                    |         | ×        | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 47. <i>Holesthes heterodon</i> Eigenmann.....               |                                   |                 |                    |         |          |           |                    | ×       |                   |                                               |                   |              |                                         |                |
| 48. <i>Odontostilbe hastata</i> Eigenmann.....              | ×                                 |                 |                    |         |          |           |                    |         | ×                 | ×                                             | ×                 | ×            |                                         |                |
| 49. <i>Odontostilbe drepanon</i> Fowler.....                |                                   |                 |                    |         | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 50. <i>Odontostilbe fugitiva</i> Cope.....                  |                                   |                 |                    | ×       | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 51. <i>Odontostilbe microcephala</i> Eigenmann.....         |                                   |                 |                    |         | ×        | ×         |                    | ×       |                   |                                               |                   |              |                                         |                |
| 52. <i>Odontostilbe pulehra</i> (Gill).....                 |                                   |                 | ×                  |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
| 53. <i>Odontostilbe paraguayensis</i> Eigen. & Kennedy..... |                                   |                 |                    |         |          | ×         |                    |         |                   |                                               |                   |              |                                         |                |
| 54. <i>Odontostilbe madeiræ</i> Fowler.....                 |                                   |                 |                    |         | ×        |           |                    |         |                   |                                               |                   |              |                                         |                |
| 55. <i>Odontostilbe melandela</i> Eigenmann.....            |                                   | ×               |                    |         |          |           |                    |         |                   |                                               |                   |              |                                         |                |
|                                                             | 3                                 | 4               | 1                  | 13      | 12       | 13        | 6                  | 5       | 2                 | 4                                             | 4                 | 2            | 1                                       | 1              |

<sup>1</sup> Habitat unknown. For *Megalamphodus ecuadorensis* sp. nov. Cf. Appendix.

The paired species are as follows:

Rio Madeira and its tributaries

*Aphyocharax alburnus*

*Aphyocharax pusillus*

*Prionobrama filigerus*

Rio Paraguay

*Aphyocharax dentatus*

*Aphyocharax anisitsi*

*Prionobrama paraguayensis*

*Cheirodon pisciculus*, which ranges in western Chile at least from Santiago to Puerto Montt, is one of two species of this group found on the Pacific slope. This species also has the distinction of being the only member of the family of Characins

ERRATA:

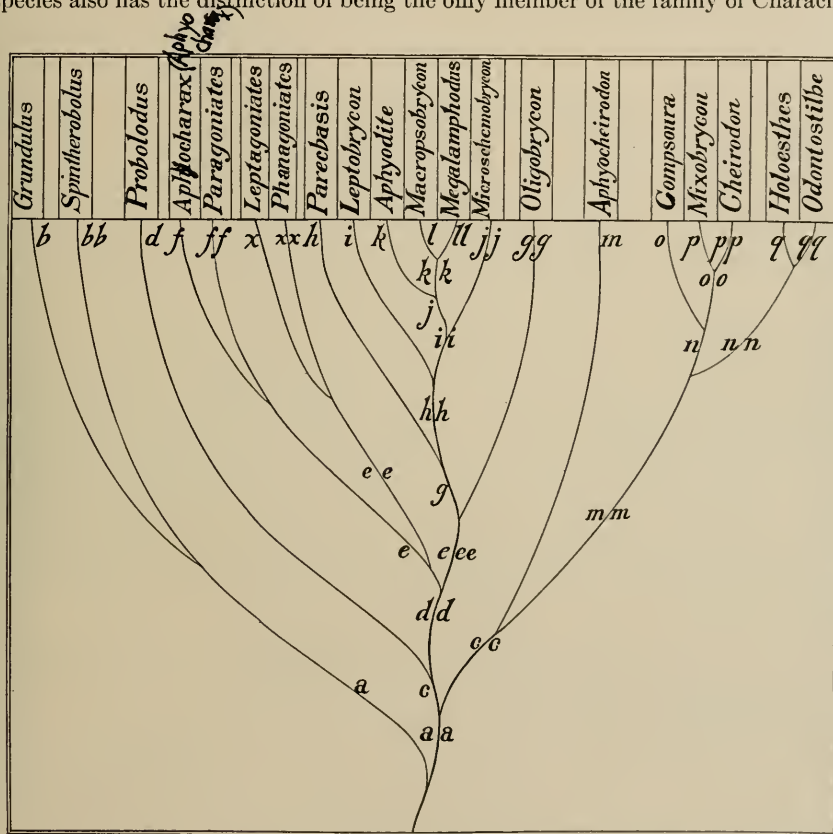


FIG. 2. Phylogenetic arrangement of the genera of the Cheirodontinæ. In this diagram the letters correspond to and have the significance of the same letters in the following key. The genus *Paragoniates*, in the diagram, includes the genus *Prionobrama*, now recognized as distinct.

which is found on the Pacific slope south of the dry area of central South America. Members of the genera *Cheirodon* and *Odontostilbe* are found in the Chagres and Atrato rivers in Panama and Colombia. *Megalamphodus ecuadorensis* is known from one specimen taken in western Ecuador.

The highest altitude is reached by *Grundulus*, which swarms in the streams of the plains of Bogotá at an elevation of about 9,000 feet. Several species are found in the San Francisco basin at a considerable elevation. The rest are, as far as known, confined to the low lands.

#### PHYLUM PISCES Artedi.

#### Class TELEOSTOMI Bonaparte.

#### SUPERORDER OSTARIOPHYSI Sagemehl.

#### Order PLECTOSPONDYLI Cope.

#### Suborder HETEROGNATHI Cope.

#### Family CHARACIDÆ Gill.

#### Subfamily CHEIRODONTINÆ Eigenmann.

Teeth well-developed, in a single series, arranged vertically in the premaxillary, dentary, and usually the maxillary. Usually some of the teeth with one or more notches or cusps symmetrically arranged on either side of the median cusp. Ventral surface rounded or slightly compressed, without serrations; body scaled; a parietal and a frontal fontanel; dorsal short, with eleven or fewer rays; gill-membranes free from the isthmus and from each other; nares close together, separated by a flap only; adipose fin usually present.

#### KEY TO THE GENERA OF THE CHEIRODONTINÆ.

- a. No adipose fin; mouth small; armature of cheeks very weak. Teeth conic or tricuspid in both jaws; lateral line incomplete.
  - b. Predorsal area partly naked; tactile papillæ normal; teeth all conic in a regular series.
    - 1. *Grundulus* Valenciennes.
  - bb. Predorsal area entirely scaled; tactile papillæ excessively developed; teeth mostly tricuspid or conical.
    - 2. *Spintherobolus* Eigenmann.
- aa. Adipose fin well developed, except in No. 7, *Phanagoniates*, which see.
  - c. Teeth tricuspid or conic.
    - d. Teeth few, very heavy, tricuspid, five or six in each dentary, of which the first is directed upward and outward, the third laterad, the fourth and later ones upward, at nearly a right angle to the

- third; premaxillary with three or four teeth directed downward and forward, maxillary with three to five similar teeth; third suborbital covering entire cheek in adult; three postorbitals with only a very narrow naked border; scales small, 45-53; lateral line complete; anal long; interhæmals normal. . . . . 3. *Probolodus* Eigenmann.
- dd. Teeth slender, tricuspid, or conical in both jaws. Interhæmals normal.<sup>4</sup>
- e. Third suborbital covering the entire cheek, two postorbitals, of which the upper is minute, the lower very large, similar to the third suborbital, and covering the entire area from eye to pre-opercle; lateral line incomplete. Anal with seventeen to twenty-seven rays in "f" and twenty-nine to nearly forty in "ff."
- f. Anal short, with a blunt lobe or none; origin of anal behind the vertical from the middle of dorsal; mouth variable, maxillary with from two to twenty teeth; dorsal and ventral profiles similar in front of the vertical from the dorsal; caudal naked.
4. *Aphyocharax* Günther.
- ff. Anal long, the anterior rays long, filiform; origin of anal about on the vertical from the origin of the dorsal; mouth large, maxillary with teeth along its entire margin directed downward and backward, largest near the middle; ventral profile much more arched than the dorsal. . . . . 5. *Prionobrama* Fowler.
- ee. Third suborbital large, the fourth in one genus at least smaller than the fifth or second postorbital. Anal with more than forty rays, its origin in advance of that of the dorsal.
- xx<sup>5</sup>. Adipose dorsal small; lateral line incomplete; anal not falcate; teeth along entire maxillary; origin of dorsal but little behind vertical from origin of anal, which is equidistant from snout and base of middle caudal rays.
6. *Paragoniates* Steindachner.
- xx<sup>5</sup>. Adipose dorsal small; lateral line complete; origin of anal equidistant from snout and the fourth fifth of its base. . . . . 7. *Leptagoniates* Boulenger.
- xxx<sup>5</sup>. No adipose; lateral line short; origin of anal equidistant from the snout and the posterior fourth of its base. . . . . 8. *Phanagoniates* Eigenmann & Wilson.
- eee. Third suborbital variable; three postorbitals, of which the uppermost is minute; all of them sometimes feeble. Anal moderate, its origin behind that of the dorsal.
- g. Teeth minute, very slender, many conical, except in No. 17.
- h. Lateral line complete; caudal lobes partly scaled; no pseudotympanum; third suborbital covering entire cheek; postorbitals large, but feeble; maxillary without teeth, its upper margin thickened; sides of lower jaw raised, without teeth; origin of dorsal in front of the middle. . . . . 9. *Parecbasis* Eigenmann.
- hh. Lateral line incomplete.
- i. Anal short, of fourteen rays, the highest extending beyond the tip of the last, its base equal to length of caudal peduncle; no teeth on the sides of the lower jaw, or on the maxillary; sides of the lower jaw high, as in *Parecbasis*; maxillary large, its outer margin very convex; lateral line very short.
10. *Leptobrycon* Eigenmann.
- ii. Anal long, twenty-three to thirty rays, the highest ray not extending to the base of the last ray.

<sup>4</sup> Dorsal 9-11, Cheirodontinæ; the Crenuchinæ, which are similar to the foregoing, have dorsal 15-18.

<sup>5</sup> The letters *x*, *xx* and *xxx* are used here out of order because text-figure 2, in which the letters were made to agree with those in the key, was drawn before genera 6 to 8, which are quite aberrant, were included in this monograph.



- j. Lateral line with but few pores; cheeks behind the eye mostly naked.  
 k. Caudal partly scaled.....11. *Aphyodite*<sup>6</sup> Eigenmann.  
 kk. Caudal naked.  
 l. Pseudotympanum conspicuous; no teeth on maxillary; interorbital very convex; frontal fontanel moderate; premaxillary with five to seven mostly conical teeth, similar to *Parecbasis*; the lateral line incomplete.....12. *Macrobrycon* Eigenmann. ERRATA  
 ll. No pseudotympanum; maxillary with two to twenty teeth; four to eight tricuspid teeth in front part of mandible, minute teeth on side; fontanels very large...13. *Megalampodus* Eigenmann.  
 jj. Lateral line extending to within four scales of the caudal. Twenty-five or more teeth on each ramus of the mandible; twelve teeth on the maxillary; frontal fontanel moderate; cheeks behind as well as below the eye covered; mouth moderate; subfusiform.  
 14. *Microschemobrycon* Eigenmann.  
 gg. Teeth heavy, four on the premaxillary; mouth minute; maxillary not reaching to below eye, with one or two teeth; origin of dorsal equidistant from snout and caudal; no pseudotympanum; three postorbitals covering nearly the entire postorbital area.  
 15. *Oligobrycon* Eigenmann.  
 cc. Teeth in part at least with five or more lobes.  
 m. Sides of teeth nearly parallel, those of the upper jaw narrow, with a prominent median cusp and one or two minute cusps on each side, about ten teeth in each premaxillary; mandible with three- to five-lobed teeth, much expanded at tip, the three middle lobes equal in size, blunt, those of successive teeth in contact, forming a continuous cutting edge, the lateral lobes excessively minute; mouth large, cheeks partly naked; frontal fontanel very short; no pseudotympanum; interhæmals normal; lateral line incomplete...16. *Aphyocheirodon* Eigenmann.  
 mm. Teeth with five or more points, tops of those of the lower jaw not forming a continuous cutting edge.  
 n. Lateral line incomplete.  
 o. Male with a lobe of large scales extending along the base of the middle caudal rays; all but three or four last anal rays of the male with hooks; interhæmals of the caudal peduncle weak; mouth minute; maxillary barely reaching to below eye; second suborbital covering the entire cheek; postorbitals very weak; no pseudotympanum; frontal fontanel moderate.....17. *Compsura* Eigenmann.  
 oo. Caudal of male without a median lobe of scales.  
 p. Interhæmals of the caudal peduncle of the male, next the caudal, feeble; no pseudotympanum; teeth heavy, one on the maxillary; third suborbital with a naked border.....18. *Mixobrycon* Eigenmann.  
 pp. Interhæmals of the caudal peduncle, especially in the male, prominent, spine-like, protruding; a conspicuous pseudotympanum; one to three teeth on the maxillary; teeth of upper and lower jaw similar, with five or more points.  
 19. *Cheirodon* Girard.  
 nn. Lateral line complete; interhæmals feeble, not projecting; maxillary with a few broad-tipped teeth; second suborbital in contact with the preopercle below.  
<sup>6</sup> *Aphyodite*, *Macropsobrycon*, and some of the species of *Megalampodus* are very similar.

- q. Premaxillary teeth but little expanded toward the tips, pointed, the median point a little the larger; mandibular teeth much expanded at the tip, with a small basal notch on each side and three median points of about the same size; third suborbital in contact with the preopercle below; fontanel short ..... 20. *Holesthes* Eigenmann.
- qq. Teeth of the upper and lower jaws similar; maxillary with a few broad-tipped teeth; third suborbital in contact with the preopercle below. Caudal in the male naked or with a row of scales reaching to the tip of the rays just below the shortest ones at the middle.....21. *Odontostilbe* Cope.

Genus *GRUNDULUS*<sup>7</sup> Valenciennes.

*Grundulus* Valenciennes, Hist. Nat. Poiss., Vol. XVIII, 1846, p. 216.

*Ctenocharax* Regan, Ann. & Mag. Nat. Hist. (7), Vol. XX, 1907, p. 402.

**Type:** *Pacilia bogotensis* Humboldt.

Cyprinodontoid fishes, reaching a length of about 80 mm., found on the eastern highlands of Colombia.

Teeth all recurved, conical, in a single series on greater part of maxillary, on premaxillary and mandible; third suborbital in the largest specimens a little wider than the naked area around its convex border, narrower than the naked area in the young; postorbital area naked; mouth small, maxillary just about reaching the orbit; eye comparatively small, placed high; a wide naked strip from dorsal to head, and another along middle of belly; dorsal placed behind the middle; origin of ventrals near the middle; anal short; no adipose fin; pectorals not nearly reaching ventrals; lateral line short; scales with very many faint, diverging radial striæ; no pseudotympanum. Gill-rakers about 8 + 10, very short, about one-third as long as eye; a few feeble interhæmals appearing as caudal fulcra; a larger number of interneurals, but equally feeble.

1. *Grundulus bogotensis* (Humboldt). (Plate II, fig. 1.)

Native name "*Guapuche*."

*Pacilia bogotensis* Humboldt, Recherches sur les Poissons Fluviatiles, in Rec. d'Observations, Zoölogie et Anat. Comp., Vol. II, 1821, pp. 154 and 159, pl. XLV, fig. 1.

*Ctenocharax bogotensis* Regan, Ann. and Mag. Nat. Hist. (7), Vol. XX, 1907, p. 403 (Bogotá).

**Range:** The rivers of the plains of Bogotá and northward in the streams of Santander.

5084, C. M., 12843, I. U. M., over one thousand specimens, largest 80 mm.

North of Bogotá at Puente de Suba. Eigenmann.

<sup>7</sup> Probably from *Grundules*, an appellation of the Lares.

5085, C. M., 12844, I. U. M., eighty. Esperanza. Eigenmann.

5086, C. M., 12845, I. U. M., two. Electric light plant at edge of plains of Bogotá. Eigenmann.

5087, C. M., 12856, I. U. M., one hundred and fifty. Madrid. Eigenmann.

5491, C. M., 13182, I. U. M., nine, largest 70 mm. Boyaca, Rio Chiquinquiseto. Gonzales.

5492, C. M., 13183, I. U. M., three. Quebrada Zuaita, Santander. Gonzales.

Head 3.5-3.7; depth 3-3.3; D. 11, rarely 10; A. 13-16; scales in a median series 32-34 of which 4 to 6 bear pores; eye 4-4.45 in the head, equal or nearly equal

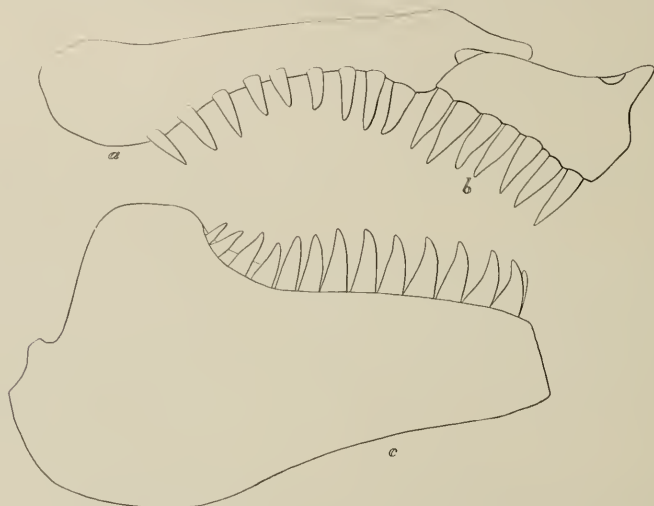


FIG. 3. *Grundulus bogotensis* (Humboldt). a, maxillary; b, premaxillary; c, mandible.

to the snout, 1-1.33 in the interorbital. Compressed but heavy, dorsal and ventral outlines equally curved; the head rather blunt. Preventral area rounded, naked in the middle below the pectorals, the scales bordering the naked area rounded, isolated from each other; area along base of dorsal narrowly naked, a naked area in front of the dorsal as wide as the eye, growing wider toward the head and extending on both sides of the occipital process; the scales bordering the area sub-circular, small, isolated from each other; occipital process reaching about one seventh to the dorsal; interorbital broad; frontal fontanel large, entirely separating the frontals in the young, in contact for a variable length in the adult, frontal fontanel being nearly as long or only half as long as the parietal. Mouth moderate,

the maxillary oblique, about equal to length of eye; seven to nine teeth in the premaxillary, nine or ten teeth in the maxillary, about thirteen to sixteen teeth on the dentary; tooth-bearing portion of dentary over half the length of the lower jaw.

Origin of dorsal about equidistant from preopercle and base of middle caudal rays; margin of dorsal rounded, the fifth ray highest, little if any longer than post-orbital portion of head; caudal but feebly forked, its lobes short, about equal to length of head less snout; origin of anal under posterior part of dorsal; base of anal half as long as head, or a little longer; margin of anal nearly straight or rounded in front, without lobe, the fifth ray highest; ventrals nearly reaching anal, or a little beyond the base of the first ray; pectorals broad, reaching half-way to middle of ventrals; origin of ventrals in middle, or a little behind the middle of the distance from snout to caudal.

Scales of middle of sides large, decreasing rapidly towards the back and belly. No scales on base of anal or caudal.

Sides reticulated with dark, basal angles of scales very dark; upper parts of head and naked predorsal area blackish, an obscure humeral spot over and sometimes on the second and third scales of the lateral line; no caudal spot, a faint dusky lateral band.

#### Genus II. *SPINTHEROBOLUS* Eigenmann.<sup>8</sup>

*Spintherobolus* Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 167, Pl. V, figs. 1-4.

**Type:** *Spintherobolus papilliferus* Eigenmann.

Teeth tricuspid, in a single series in dentary, premaxillary, and upper part of maxillary; no adipose fin; lateral line on one or two scales; caudal naked; anal very short, naked; tactile papillæ excessively developed; suborbitals very feeble; predorsal area fully scaled.

#### 2. *Spintherobolus papilliferus* Eigenmann. (Plate III, figs. 1-4.)

*Spintherobolus papilliferus* Eigenmann, *l. c.*

**Range:** Upper Tieté basin.

3882, C. M., type 41 mm. 3883, C. M., paratypes, four. 25-39 mm. Alto da Serra, Tieté basin, São Paulo, Aug. 4, 1908. Haseman.

Head 3.33; depth 3; D. 11; A. 12; scales 35, 13 between dorsal and ventral; eye 4.3; interorbital 3.5 in the head.

Cyprinodontiform; profile sloping rapidly to above the ventrals; caudal peduncle a trifle less than half the greatest depth, length of the peduncle twice its

<sup>8</sup> σπινθηροβόλος, emitting sparks, referring to the appearance of the yellow tactile organs of the head.



height; predorsal area with thirteen scales, preventral area short, rounded, without a distinct median series of scales; occipital process about six times in the distance from its base to the dorsal; frontal fontanel a very narrow slit; cheeks entirely naked; the suborbitals very narrow, concealed; mouth small, terminal; about six arrow-shaped teeth on the maxillary; seven similar more distinctly three-lobed teeth on the premaxillary; eight similar and two conical teeth in each dentary; organs of lateral line excessively developed about the head, each papilla orange; no gill-rakers.

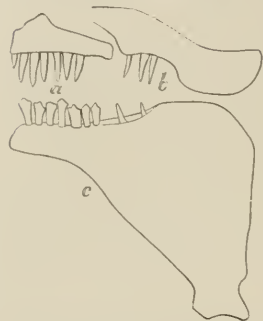


FIG. 4. *Spitherobolus papilliferus* Eigenmann. a, premaxillary; b, maxillary; c, mandible.

Origin of dorsal near middle of body, its highest ray four and one-half times in the length; caudal lobes four to four and one-half times in the length; anal very short, its origin equidistant from preopercle and caudal; ventrals reaching to the anal, as long as the base of the latter; pectorals reaching beyond the origin of the ven-

trals. Pores of lateral line on only two scales. Scales regularly imbricate, no interpolated rows; caudal and anal naked; axillary scale minute.

Scales of sides outlined in dark, a dusky spot over the scales with developed pores.

This species, which resembles *Grundulus* in many ways, is known to occur only in small rills leading into the Rio Tieté and thence into the Paraná, at Alto da Serra near the coast at Santos, São Paulo, Brazil. The related genera *Grundulus* and *Spitherobolus* are thus known from nearly opposite parts of South America.

### Genus III. PROBOLODUS<sup>9</sup> Eigenmann.

*Probolodus* Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 164, fig. 1; Pl. IV, fig. 1.

**Type:** *Probolodus heterostomus* Eigenmann.

Premaxillary with three teeth somewhat directed outward, each with three points in the angles of a nearly isosceles triangle, the middle point, which is also the anterior one, much heavier; maxillary with three to five teeth, the first two or three of which are directed outward; each ramus of the mandible with four larger teeth, the first three directed outward, the fourth and one or more smaller ones following it, directed upward; the larger teeth of the lower jaw heavy, conical, with a minute cusp on each side. Lateral line complete; caudal naked. Adipose

<sup>9</sup> προβολή = a putting forward; ὀδούς = a tooth.

well-developed. Mouth large; lower jaw heavy, its sides vertical; third suborbital in contact with preopercle below and behind in the larger, with a narrow naked border in the smaller specimens; three postorbitals covering the entire postorbital area; no pseudotympanum; frontal fontanel very long; the frontals not in contact.

### 3. *Probolodus heterostomus* Eigenmann.

*Probolodus heterostomus* Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 164, fig. 1; Pl. IV, fig. 1. (Campos on the Rio Parahyba; Iporanga on the Ribeira.)

**Range:** Southeastern Brazil in coastal streams from the Rio Doce to the Ribeira da Iguapé.

2973, C. M., **type**, 63 mm.; 2974, C. M., **paratypes**, three, 48–64 mm. Campos on the Parahyba. June 13, 1908. Haseman.

2975, C. M., **paratypes**, two, 78–81 mm. Iporanga on the Ribeira, Dec. 1, 1908. Haseman.

20910, M. C. Z., one, 77 mm. Rio Doce, between Linhares and Porto Souza, Hartt and Copeland. Thayer Expedition.

6882a, C. M., 45 mm. São João do Barra, Rio Parahyba. Haseman.

6879a–b, C. M., two, 37 and 44 mm. Jacarehy, Rio Parahyba, July 15, 1908. Haseman.

6880a–g, C. M., seven, largest 35 mm. Jacarehy, July 4, 1908. Haseman.

Head 4–4.33; depth 2.66; D. 11; A. 26–31; scales 8 or 9–45 to 53–7 to ventrals; eye 3, interorbital 2.5, snout 3.5 in the head in the type, 2.5, 3.2, 3.5 respectively in the paratypes.

Dorsal and ventral outlines nearly equally curved, without distinct humps or depressions; ventral region rounded, the postventral area narrowly so. No regular series of median scales in front of the ventrals. Predorsal area narrowly rounded, with a regular median series of about twelve scales. Occipital process about five times in the distance from its base to the dorsal, bordered by four or five scales on each side; interorbital rounded, the frontal fontanel little more than half as long as the parietal without the occipital groove. Snout sharp, the lower jaw entering the profile when the mouth is closed; a distinct angle between maxillary and premaxillary; maxillary not quite equal to length of eye; third suborbital leaving a naked border around its entire lower edge. Gill-rakers 6 + 12.

Scales everywhere regularly imbricate, except over the anal musculature; caudal naked, a weak anal sheath of one series of scales along the base of the anterior rays; each scale of the side, with several (maximum about eight) radial striae; axillary scale of the ventrals well-developed.

Dorsal small, about four times in the length; adipose well-developed; caudal forked, the lobes three and one-half to four times in the length; anal slightly emarginate, the highest ray reaching tip of thirteenth ray. Ventrals not quite reaching anal, pectorals to, or a little beyond, origin of ventrals.

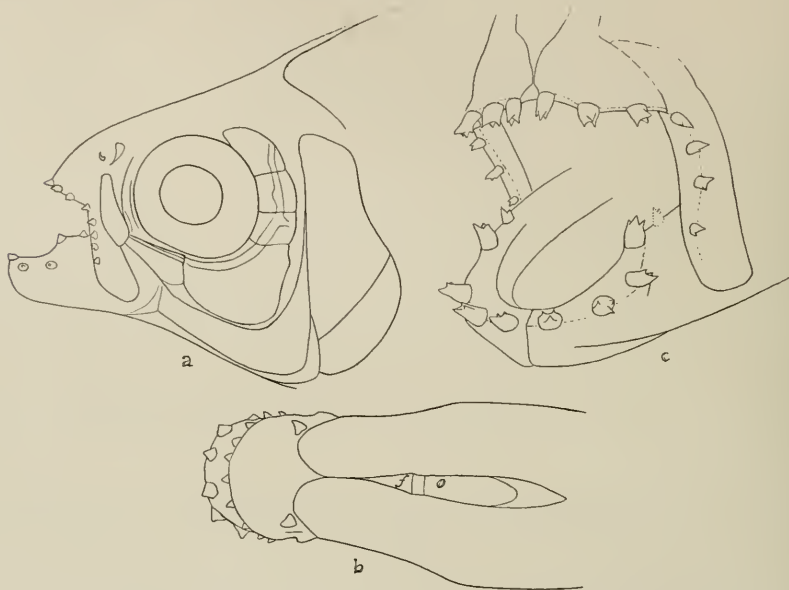


FIG. 5. *Probolodus heterostomus* Eigenmann. a, outlines of side of head; b, top of head showing frontal (f) and occipital (o) fontanelles; c, dentition. C. M. 6881.

A large vertical humeral spot, chiefly above the third and fifth scale of the lateral line; a silvery lateral band. A spot on caudal peduncle, in the young definitely continued to the end of the middle rays.

#### Genus IV. APHYOCHARAX<sup>10</sup> Günther.

*Aphyocharax* Günther, Proc. Zoöl. Soc. London, 1868, p. 245 (*pusillus*).

*Holoprion* Eigenmann, Smithsonian Misc. Coll., Quarterly, Vol. XLV, 1903, p. 145 (*agassizii*).

**Type:** *Aphyocharax pusillus* Günther.

Elongate, slender fishes, reaching a maximum length of about 80 mm., most of them much shorter.

<sup>10</sup> ἀφύνη, = a small fish, anchovy, sardine, or *Motella*; χάραξ = a pointed stick, or palisade; *Charax*, a genus of characid fishes with pointed teeth.

Head pointed, skull convex above, with parietal and frontal fontanel, the latter very short, not extending beyond middle of eye in adult; mouth terminal, greatly variable in size in different species and with age in the same species (*cf.* *A. dentatus*); teeth all in a single series, conical, and usually with a cusp on each margin; those of upper and lower jaw alternating and interlocking when the mouth is closed; those of the side of the lower jaw notably smaller than the anterior teeth; cheeks entirely covered by the suborbital; nares close together; gill-membranes free from each other; gill-rakers setiform; tongue slender, free; scales regular, of about the same size, well imbricated, cycloid, firm; caudal naked; lateral line incomplete; adipose well-developed; origin of dorsal near middle of body; no pseudotympanum; a long pore on the base of the middle caudal ray.

The genus *Aphyocharax* is well marked by the very strong armature of the cheeks, the third suborbital and the single postorbital being of the same strength and texture, and leaving but little or any of the cheek naked; the scales are firmer than in any other genus of the subfamily and they have peculiar sculpturing. There are two sub-parallel radial striæ on the exposed part of the scales; the circuli are well-marked near the base of the exposed portion of the scale and parallel with the radial striæ at this point, or converge toward a median line.

*A. dentatus*, *alburnus*, *erythrurus*, *pusillus*, and *anisitsi* form a series from the large-mouthed *dentatus* with many maxillary teeth to the small-mouthed *anisitsi* with few maxillary teeth. Of these *A. alburnus* and *A. erythrurus* are scarcely distinct. *A. dentatus* is the Paraguayan representative, *alburnus* the Amazonian, and *A. erythrurus* the Guianian. *A. anisitsi* similarly is the Paraguayan representative, *A. pusillus* the Amazonian. *A. melanotus* probably belongs to another genus. *A. avary* is probably a synonym of *pusillus*.

At the time *A. agassizi* was selected as the type of the new genus, *Holoprion*, I had not seen that species. The genus was erected in view of Steindachner's statement, "oberer Theil des Oberkiefers am ganzen vorderen Rande deutlich gezähnt." While in Vienna, I was able to examine the types. It is certain that they have several teeth along the upper anterior margin, but I was unable with a hand-lens to detect any teeth along the distal portion of the maxillary. It seems possible that the type species of the genus *Holoprion* lacks the character assigned to the genus. However, there certainly are species with this character, viz.: *paraguayensis*, *maxillaris*, and possibly *nattereri*, which may be referred to *Holoprion*, provisionally retained as a subgenus. If a final microscopic examination of *agassizi* shows that it actually lacks teeth on the distal portion of the maxillary the name *Holoprion* becomes an exact synonym of *Aphyocharax*, and a



new generic or subgeneric name will have to be given to the above named species.

Nothing is said in the original description of the teeth on the maxillary of *Cheirodon pulcher* Steindachner. The description reads "Kieferzähne einreihig, sehr klein, schlank und zahlreich." This does not apply to the genus *Cheirodon*, in which genus it is placed by Steindachner, but applies very well to *A. paraguayensis*, a species evidently very closely related to *pulcher*, but which has teeth along the entire maxillary and belongs to the genus *Holoprion* as originally defined. It is more than probable that *pulcher* also belongs here, and it is so ranked.

**Range:** Guiana, Amazon, and Paraguay, rare in the Uruguay basin.

#### KEY TO THE SPECIES OF APHYOCHARAX.

- a. Teeth not along the entire margin of the maxillary. (*Aphyocharax*.)
  - b. Dorsal without black.
    - c. Maxillary with many teeth; hooks in the male confined to the lobe of the anal; a humeral spot.
      - d. Mouth very large, the maxillary in fully grown specimens reaching to the third suborbital, 2.5 in the head; snout in the adult 3.5-3.8 in the head, but very little shorter than eye; maxillary-premaxillary border 2.1-2.33 in head; depth 3.5-3.75; middle caudal rays pale.
        - 4. *dentatus* Eigenmann & Kennedy.
      - dd. Mouth moderate, the maxillary not reaching the second suborbital.
        - c. Maxillary with 9-20 teeth extending over more than half the length of the maxillary; scales 37-40.
          - f. Premaxillary with six to eight teeth, mandible with 16-20; middle caudal rays dusky; a well-developed humeral spot; A. 17-19; depth 4.25-4.5; snout over 4 in the head; maxillary 3.25 in head. . . . . 5. *alburnus* (Günther).
          - ff. Premaxillary with six teeth, mandible with about thirteen; A. 17; middle caudal rays pale, caudal red in life. . . . . 6. *erythrus* Eigenmann.
          - fff. Maxillary with teeth along about one-third to two-fifths its length; premaxillary with seven teeth, mandible with nine; A. 18; scales 36, 8 with tubes; head 4.5; depth 4.5; middle caudal rays black. . . . . 7. *pusillus* Günther.
      - cc. Maxillary with two to four teeth, mouth small; depth 3-3.75; scales 5 or 5.5-30 to 35-4.5 to 6; mandible with nine to ten teeth; hooks in the male on nearly all anal rays; no humeral spot.
        - 8. *anisitsi* Eigenmann & Kennedy.
    - ccc. Maxillary with four teeth; mouth moderate, maxillary reaching to below anterior margin of pupil; depth 4.25; scales 38; A. 17. . . . . 9. *avary* Fowler.
  - bb. Dorsal, at least in male, with black. Mouth minute; posterior part of anal margined with black, the black extending obliquely across the lobe; hooks in the male on nearly all anal rays; depth 3; A. 19 or 20; maxillary very short, convex, not reaching eye, with two teeth or none; premaxillary with five to seven teeth; six to nine on the mandible. . . . . 10. *rathbuni* Eigenmann.
- aa. Teeth along the entire margin of the maxillary (*Holoprion*).
  - g. Dorsal plain; a black border or band from the tip of the last anal ray to the lobe, thence obliquely to the anterior rays and forward to near the ventrals; no humeral spot; origin of dorsal behind the middle; a black caudal spot.

- h.* Scales 34; caudal spot not continued to the end of the middle rays. . 11. *paraguayensis* Eigenmann.  
*hh.* Scales 30; caudal spot continued to the end of the middle rays. A. 23. 12. *nattereri* Steindachner.  
*gg.* Dorsal with a black spot; no caudal spot.  
*i.* A black band along the tips of the shorter anal rays and across the middle of the elongate rays;  
 A. 27; scales 30. . . . . 13. *agassizi* Steindachner.  
*ii.* A small, black spot near the tips of the first few anal rays; A. 22-23; scales 30.  
 14. *maxillaris* Ulrey.

4. *Aphyocharax dentatus* Eigenmann & Kennedy. (Plate IV, fig. 1.)

? *Aphyocharax (Chirodon) alburnus* Perugia, Ann. Mus. Civ. Storia Nat. Genova, (2), Vol. XVIII, 1897, p. 25 (Rio Beni; Missioni Mosetenes).

*Aphyocharax dentatus* Eigenmann and Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 576. (Asunción; Arroyo Trementina); Eigenmann, Ann. Carnegie Mus., Vol. IV, 1907, p. 126 (Corumbá, Puerto Max; Rio Negro; Rio Pilcomayo); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

**Range:** Paraguay basin.

10032, I. U. M., **type**, 71 mm. and 10033, 10036, 10037, 10038, I. U. M., ten. Asunción. Anisits.

10034 and 10035, I. U. M.; 932a & b, C. M. Aguadas near Arroyo Trementina. Anisits.

10290 and 10187, I. U. M., nine. R. Paraguay, Corumbá. Anisits.

10190, I. U. M., one. Rio Paraguay, Puerto Max. Anisits.

10230, I. U. M., ten. Tributary of the Rio Negro emptying into Rio Pilcomayo. Anisits.

6911a, C. M., one, 37 mm. Asunción, Paraguay. Haseman.

6912a-q, C. M., seventeen, 23-72 mm. R. Paraguay, Caerres, May 26, 1909. Haseman.

1913a-j, C. M., eleven, all females, largest 52 mm. Corumbá, May 9, 1909. Haseman.

6914a-e, C. M., five (one male) 56-64 mm. Corumbá, April 27, 1909. Haseman.

7313a-j, C. M., ten, largest about 72 mm. Villa Hays, April 13, 1909. Haseman.

?7314a-e, C. M., three, largest about 25 mm. Santa Rita, June 12, 1909. Haseman.

Head 4-3.8; depth 3.6-3.75 (3.4-4 in extremes); D. 11; A. 18-22; scales 5.5 to 7-36 to 42-4.5 to 6; 7 to 14 scales with pores; eye 3.5-4 in the head, 1 in snout; interorbital 3-3.33 in the head.

Elongate, compressed-fusiform; dorsal and ventral profiles regularly and about equally arched; preventral area broad, rounded, with a median series of about seventeen scales; predorsal area rounded, with a median series of about fourteen scales, the regularity of the series broken near the middle; occipital process reaching about one-eighth to one-ninth to the dorsal, bordered by two to three scales; skull smooth, slightly convex; fontanels narrow, the frontal fontanel reaching to above

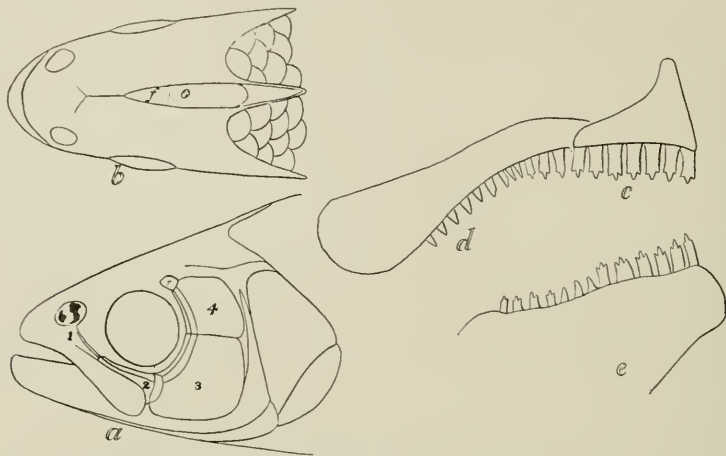


FIG. 6. *Aphyocharax dentatus* Eigenmann & Kennedy. *a*, outline of head, 9 mm. long, showing size of maxillary in a specimen 68 mm. long; 1, 2, 3, suborbitals, 4, 5, postorbitals. *b*, outline of top of head showing frontal (*f*), and occipital (*o*) fontanels. *c*, premaxillary, *d*, maxillary, *e*, mandible, much enlarged, from a specimen 28 mm. long, 10036, I. U. M.

the middle of the eye, its length about two and one-half times in the length of the parietal fontanel without the groove; snout pointed, the mouth large, terminal, the jaws equal; maxillary in adult reaching to the third suborbital; maxillary-premaxillary border two and one-third times in the head, maxillary relatively much shorter in the young; teeth recurved, slender, acutely pointed, those in the front of the jaws with a minute cusp on each side; premaxillary with seven to ten teeth; maxillary with nine to twenty on more than half of its edge; mandible with thirteen to twenty-one teeth; teeth of the premaxillary and of the front of the mandible all of about the same size; third suborbital in contact with the preopercle below and behind; a single postorbital, similar to the third suborbital, its face convex, its posterior margin in contact with the preopercle; upper part of the opercle similar to, but smaller than the postorbital. Gill-rakers 7 + 9.

Origin of dorsal equidistant from tip of snout and base of middle caudal rays or a little nearer the latter; dorsal truncate, tip of third to seventh ray about equal when the fin is half closed; highest ray a little shorter than head; adipose fin small, but well developed; caudal lobes about equal to length of head; origin of anal under end of dorsal, last twelve rays of anal of about the same height, the third to eighth forming a lobe two and a half times as high as the posterior rays, very little longer than snout and eye; ventrals not reaching anal by three or four scales, their origin far in advance of the dorsal; pectorals not reaching ventrals by two to three scales.

Scales everywhere very regularly imbricate, pores developed on seven to fourteen scales and on the last scale of the series above the lateral line series, a long tube on the base of the middle caudal ray; sheath of scales covering the basal fifth of the caudal lobes, the last scale on each lobe largest; anal with not over four scales forming a sheath for the anterior rays; axillary scale large; scales usually with two sub-parallel radials, the circuli on at least the basal part of the exposed portion of the scale prominent above and below.

A diffuse, but quite evident, shoulder-spot; margin of caudal dusky, a silvery lateral band; first dorsal ray dark, a few chromatophores on the membranes from the middle of the first to the tip of the penultimate, forming a very faint, oblique band; bases of some of the rays dusky.

Male with hooks on the third to the eighth anal ray; *i. e.*, on the anal lobe, which is equal to the snout and eye.

This is the largest species of the genus and is abundant in the Paraguay to San Luiz de Caceres.

##### 5. *Aphyocharax alburnus* (Günther).

*Chirodon alburnus* Günther,<sup>11</sup> Proc. Zool. Soc. London, 1869, p. 424, fig. 2 (Peruvian Amazons).

*Aphyrocharax alburnus* Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 292; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 292; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

<sup>11</sup> Günther's original description is very brief and reads:

"D. 10. A. 20. L. lat. 37. L. transv. 11.

The height of the body is a little more than the length of the head, and one-fourth of the total (without caudal). Upper profile of the head not concave. The pectoral does not extend to the ventral. Teeth scarcely compressed, pointed, with a minute (microscopical) lobe on each side; there are about twelve in the upper and eighteen in the lower jaw. Sides with an ill-defined silvery longitudinal band; the middle caudal rays blackish.

Two and a half inches long."



Range: Amazon basin.

11087, I. U. M., one, 58 mm. Rio Jurua. From British Museum.

6915a-i, C. M., four females, 47-55 mm., six males, 34-43 mm. Santarem, Dec. 6, 9, and 15, 1909. Haseman.

20713a-b, M. C. Z., two, 37 mm., Villa Bella. L. Agassiz. Thayer Expedition.

20813a-f, M. C. Z., six, largest 51 mm. Iça. William James. Thayer Expedition.

20813a-d, C. M., four, largest 39 mm. San Joaquin, Bolivia, Sept. 4, 1909. Haseman.

Head 4.2-4.5; depth 4.2-4.5; D. 11; A.  $\frac{17}{3}$ ,  $\frac{18}{3}$ ,  $\frac{19}{1}$ ; scales 39-40, of which 10-12 with pores; eye 3 in head, snout 4 in head, interorbital slightly larger than eye.

Maxillary always falling short of the third suborbital; maxillary-premaxillary border three times in the head, in the largest specimen; premaxillary with six to eight teeth; maxillary with ten to sixteen teeth on over half the length of the maxillary; mandible with eight large teeth and eight small ones on the side.

Margin of caudal and the middle rays dusky. In all other respects the description of *dentatus* applies to this species.

#### 6. *Aphyocharax erythrurus* Eigenmann.

*Aphyocharax erythrurus* Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 313, Pl. XLIV, fig. 4 (Rockstone, Crab Falls, and Maripieru Creek, British Guiana.)

1879a, C. M., type. 1880a-c, C. M.; 12161, I. U. M., paratypes, 28-58 mm. Rockstone. Eigenmann.

1881a, C. M., paratype, 29 mm. Maripieru Creek. Grant.

2494a, C. M., paratype, 35 mm. Crab Falls. Eigenmann.

Head about 4; depth 3.66-4; D. 10 or 11; A. 17 or 18; scales 5-34 to 37<sup>12</sup>-3; nine to eleven scales with pores; eye a little longer than snout; 3.5 in the head; interorbital 3 in the head.

Maxillary-premaxillary border 2.5-2.75 in the head; six teeth in the premaxillary, twelve to fourteen along the greater part of the maxillary, about thirteen in the dentary. Middle caudal rays pale.

This species is almost identical with *alburnus*, but can readily be distinguished by the pale middle caudal rays and the slightly longer maxillary.

#### 7. *Aphyocharax pusillus* Günther.

*Aphyocharax pusillus* Günther, Proc. Zool. Soc. Lond., 1868, p. 245 (Huallaga; Xeberos); Cope, Proc. Acad. Nat. Sci. Phila., 1871, p. 260 (Ambyiacu); Cope,

<sup>12</sup> And a few on the caudal.

Proc. Am. Philos. Soc., Vol. XVII, 1878, p. 689 (Peruvian Amazon); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 55; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1885, p. 292; ? Boulenger, Ann. & Mag. Nat. Hist. (7) Vol. II, p. 478 (Jurua)<sup>13</sup>; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, 333, fig. 22 (Ambyiaçu, Peruvian Amazon.)

**Range:** Marañón basin; Madeira basin.

6917a, C. M. 50 mm. Palo Grande Fall, Rio Mamoré, Sept. 30, 1909. Haseman.

6918a-b, C. M. two, larger 58, Berlin, Bolivia, Sept. 15, 1909. Haseman.

6919a, C. M. one, 43 mm. Maciél, Rio Guaporé, July 2, 1909. Haseman.

Head 4.33-4.8; depth 4-4.3; D. 11 or 12; A. 18 or 19; eye 3-3.5 in the head, 1 in snout; interorbital 2.6-3 in the length of the head.

Maxillary-premaxillary border three times in the head, maxillary about four times; maxillary with five to eight teeth on one-third to one-fourth of the margin; premaxillary with seven teeth; mandible with ten to sixteen. Middle caudal rays dark.

This species differs from *alburnus* in the number of maxillary teeth.

#### 8. *Aphyocharax anisitsi* Eigenmann & Kennedy. (Plate III, fig. 6.)

*Aphyocharax anisitsi* Eigenmann & Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 517 (Asunción; Campo Grande; Arroyos Trementina and Chagalalina); Eigenmann, Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429.

**Range:** Paraguay basin; Cacequy, Uruguay basin.

10024, 10026, I. U. M.; 936a-b, C. M., fifteen specimens, Campo Grande. Anisits.

6920a-k, C. M., twelve (four males), largest 35 mm., Asunción, March 28, 1909. Haseman.

10028, I. U. M., type, 41 mm.; 10027 & 10029, I. U. M., three, Asunción. Anisits.

6921a, C. M., one, 37 mm. Puerto Suarez, Bolivia. Steinbach.

10031, I. U. M., one, Arroyo Trementina. Anisits.

10025, I. U. M., one, Arroyo Chagalalina. Anisits.

6222a-c, C. M., three, largest 32 mm. to base of caudal. Cacequy. R. Ibiculy, into Uruguay. Haseman.

Head 3.75-4.2; depth 3-3.75; D. 10 or 11; A.  $\frac{1.8}{2}$ ,  $\frac{1.9}{2}$ ,  $\frac{2.0}{4}$ ,  $\frac{2.1}{1}$ ,  $\frac{2.3}{1}$ ; scales 30-35,

<sup>13</sup> I have specimens of *alburnus* from the Jurua sent by the British Museum. It is possible that these are some of the specimens identified as *pustillus* by Boulenger.

6 to 9 with pores; eye 2.75–3.33 in the head, .5–.75 in the snout; interorbital 2.4 in the length of the head; interorbital a very little greater than eye.

About thirteen preventral scales, an equal number of predorsal scales; maxillary-premaxillary border three times in the head, maxillary about two-thirds as long as the eye. Premaxillary with six to eight teeth; maxillary with two to four, mandible with nine to ten; mouth small, the maxillary scarcely reaching to eye; pectorals reaching ventrals; origin of dorsal nearer caudal than to tip of snout.

Anal and caudal sometimes margined with dark; chromatophores on the dorsal rays; outer pectoral ray sometimes dark; no humeral spot.

Anal in the male with four, rarely more, hooks on all the rays but the first

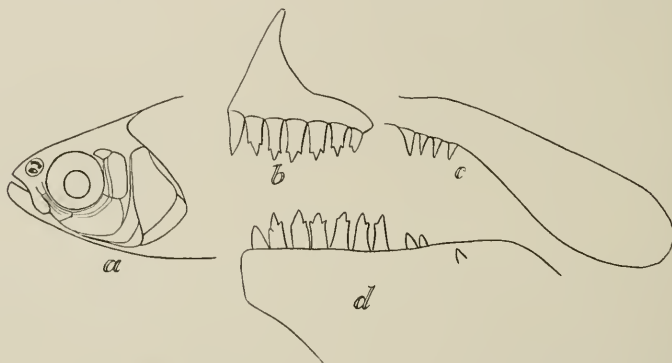


FIG. 7. *Aphyocharax anisitsi* Eigenmann. a, side of head; b, c, d, premaxillary, maxillary, and portion of mandible of a specimen, 10029, I. U. M. 28 mm. to base of caudal.

two and the last, the hooks strongest on the posterior rays and on the middle third of the rays.

While quite similar in general appearance to *dentatus*, this species differs in many ways. It is smaller, deeper, has fewer scales, much fewer maxillary teeth, a smaller mouth and different color. The anal in the male with hooks on practically all the developed rays, is quite different from that of *A. dentatus*, which has hooks on only the rays of the lobe.

#### 9. *Aphyocharax avary* Fowler.

*Aphyocharax avary* Fowler, Proc. Acad. Nat. Sci., Phila., 1913, p. 532.

Known only from the type, 54 mm. long, from the Madeira River about two hundred miles east of Long. 62° 20', Brazil.

Head 3.87; depth 4.25; D. 13; A. 17; scales forty-two, of which eleven are

with tubes; eleven scales between dorsal and ventrals; nineteen predorsal scales; depth of caudal peduncle 2.4 in the length of the head; height of dorsal 1.25; height of anal 1.66; length of pectoral 1.33; ventral 1.6.

Elongate, slender, fusiform; maxillary reaching to below anterior margin of pupil; teeth conic, each usually with a very small or obsolete pointed basal cusp; maxillary with about four conic teeth.

Origin of dorsal midway between posterior nostril and base of caudal; origin

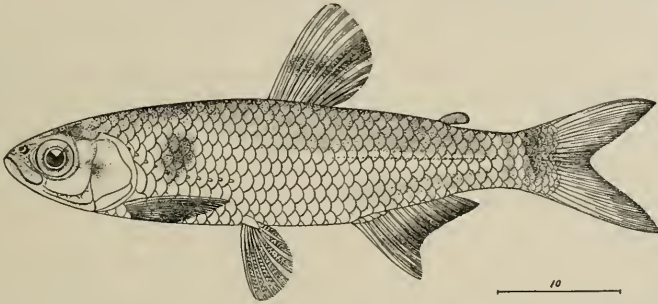


FIG. 8. *Aphyocharax avaray* Fowler. (After Fowler, Proc. Acad. Nat. Sc., Phila., 1913, p. 532.)

of anal behind the vertical from the base of the last dorsal rays; origin of ventrals well before the dorsal.

A silvery lateral band; humeral spot crossing third, fourth, and fifth scales of the lateral line; dorsal with a transverse median streak. Anal broadly whitish in front; rest of fin sprinkled with dusky dots, the edge of the fin dark, the dark continued across the anal lobe.

10. *Aphyocharax rathbuni* Eigenmann. (Plate III, fig. 5.)

*Aphyocharax alburnus* Eigenmann & Kennedy (*non* Günther), Proc. Acad. Nat. Sci., Phila., 1903, p. 517.

*Aphyocharax anisitsi* (part) Eigenmann and Kennedy, Proc. Acad. Nat. Sci., Phila., 1903, p. 517.

*Aphyocharax rathbuni* Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 10. (Arroyo Chagalalina, Paraguay); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Aphyocharax stramineus* Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 11 (Arroyo Trementina); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin.



10025, I. U. M., one, 26 mm. to base of caudal. Arroyo Chagalalina, Paraguay basin. J. D. Anisits. **Type of *rathbuni*.**

10030, I. U. M., one, 25 mm. to base of caudal. Arroyo Trementina. J. D. Anisits. **Type of *stramineus*.**

A close comparison of *rathbuni* and *stramineus* in the light of the study of the group of the *Cheirodontinae* makes it quite probable that *stramineus* is the female of *rathbuni*.

No additional material was collected by Haseman.

Head 4; depth 3; D. 11; A. 19 or 20; scales 35, 9 between dorsal and ventrals; eye 2.6-3 in the head, equal to the interorbital; snout about half length of eye.

Elongate, compressed; preventral area rounded, without a distinct median series of scales, of which there are eleven between ventrals and the isthmus; pre-dorsal area rounded, with about fourteen scales, of which about nine in front of the dorsal are in a median series; occipital process very short, reaching about

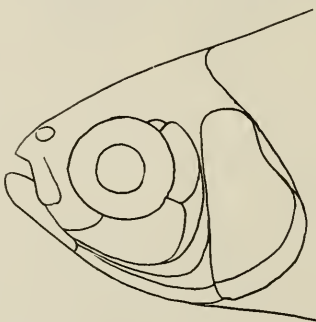


FIG. 9. *Aphyocharax rathbuni* Eigenmann. Greatly enlarged.

one-seventh to the dorsal; frontal fontanel about half as long as the parietal with its groove; second suborbital in contact with the lower limb of the preopercle along its entire margin; a naked wedge behind it; postorbital strong, its margin more convex in the male than in the female, having a naked area around its entire distal margin; lateral line tubes on the postorbital and on the third suborbital strong; mouth very small, the maxillary very short, its margin very convex, not reaching the anterior margin of the eye; premaxillary with about five teeth, maxillary with one to three; mandible with six to nine teeth, the first three rapidly graduate.

Origin of dorsal a little nearer base of caudal than tip of snout; origin of anal under dorsal; anal with a slight lobe, the end of the fin rounded; most of the anal

rays of the male with a few hooks; ventrals reaching to or nearly to the anal; pectorals not reaching to ventrals.

Seven or eight scales with pores; scales firm, mostly with two slightly divergent radial striæ; caudal naked, the scales extending but little on the base of the lobes, the last scale on each lobe large; anal naked.

No humeral or caudal spots; back thickly dusted; dorsal dusted like the back; quite black in the male, especially along its base and posterior part; margin of caudal dusky; margin of anal forward to the lobe black or dusky, a narrow dusky band extending obliquely across the lobe to the basal third; opercle with a few chromatophores, largest near its anterior margin; the color everywhere more intense in the male. The color of the anal is evidently much like that of *A. agassizi*.

Closely allied to *A. anisitsi*, the mouth still smaller.

11. *Aphyocharax paraguayensis* sp. nov. (Plate II, fig. 2.)

6906a, C. M. Type, 25 mm. 6907, C. M., paratype, 20 mm. Rio Paraguay, Caceres, May 24, 1909. Haseman.

Head 4; depth 3.5-3.8; D. 10 or 11; A. 22; scales 5 + 29; eye about three in the head, a trifle less than interorbital.

Elongate, dorsal and ventral profiles alike; preventral area rounded, without a distinct median series of scales, about fourteen rows; predorsal area rounded,

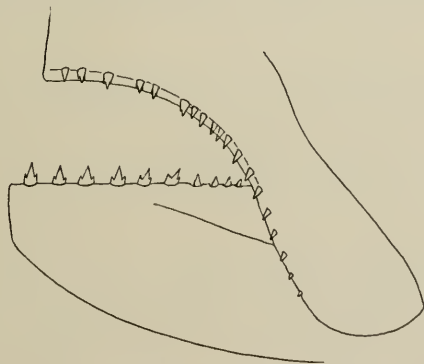


FIG. 10. Dentition of *Aphyocharax paraguayensis* Eigenmann. 6906, C. M.

with a perfect median series of thirteen scales; occipital process nearly equilateral, reaching about one-seventh to the dorsal, bordered by one and one-half scales; frontal fontanel reaching to near anterior margin of eye, but little, if any, shorter than the parietal without the groove; third suborbital in contact with the pre-

opercle in front and behind; a single postorbital, its lower half in contact with the vertical limb of the preopercle, a naked margin behind its upper half; no tubes on the suborbital or postorbital; mouth large, very oblique, the chin entering the profile; the maxillary-premaxillary border a gentle curve, longer than eye; maxillary reaching beyond suture between second and third suborbital; maxillary with thirteen conical teeth along practically its entire margin; premaxillary with six slightly graduate teeth with a small notch on each side near the tip of each tooth; mandible with twelve graduate teeth along the greater part of its margin, similar to those of the premaxillary, the lateral ones simply conic. Gill-rakers 4 + 7.

Origin of dorsal equidistant from tip of snout and near end of middle caudal rays; the highest ray a little shorter than head; origin of anal under anterior part of dorsal; ventrals not quite reaching anal, pectorals a little beyond origin of ventrals.

Each scale with two sub-parallel radial striæ dividing the scale into three fields of about equal height; caudal naked; pores on but few scales.

A sub-triangular caudal spot, its base across the entire caudal peduncle, its tip on the basal third of the middle caudal rays; dorsal nearly evenly peppered; sides of head and abdomen silvery; chin, upper lip, and sides peppered, the peppering densest along the back and along the base of the anal, the spots becoming larger along the base of the anterior anal rays, and continued forward to the ventrals; a dark band beginning at the base of the first to fourth anal rays, extends obliquely to the tip of the sixth and along the margin of the succeeding rays; middle caudal rays without chromatophores, the lobes faintly peppered.

## 12. *Aphyocharax nattereri* Steindachner.

*Tetragonopterus diaphanus* Cope (part), Proc. Am. Philos. Soc., Vol. XVII, 1878, p. 691 (Peruvian Amazon).

*Cheirodon pulcher* Steindachner, Flussf. Südam., Vol. IV, 1882, p. 39 (Villa Bella); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 332, fig. 21 (based on Cope's specimens mentioned above).

*Cheirodon nattereri* Steindachner, Anz. Akad. Wiss., Wien, 1882, p. 180 (Villa Bella); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey (part), Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 291 (Pará); ? Boulenger, Boll. Mus. Univ. Torino, Vol. XIV, 1900 (Urucum, Matto Grosso); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Cheirodon steindachneri* Eigenmann & Eigenmann, Proc. U. S. N. M., Vol. XIV, 1891, p. 54.

**Range:** Amazons from Pará to Peru.

The names *C. pulcher* and *C. nattereri* were proposed for the same species, the latter being substituted by Steindachner for the name *pulcher*, which was pre-occupied. Without knowing that the specific name *nattereri* had been substituted by Steindachner, the name *steindachneri* was also proposed by the writer for the pre-occupied *pulcher*. It is a pure synonym.

It is quite certain that some at least of Ulrey's specimens belong to the genus *Astyanax*. It also seems doubtful whether the specimens figured by Fowler are *A. nattereri*, since they distinctly differ in color. I have no specimens at hand; the description of Steindachner may be in part reproduced:

[P. 39.] "Körperform sehr gestreckt, *Alburnus*-artig. Rücken- und Bauchlinie gleichförmig, äusserst schwach gebogen.

"Seitenlinie unvollständig. Dorsale mit ihrem ersten Strahle eben so weit von der Caudale wie vom hinteren Augenrande entfernt, somit nicht unbeträchtlich weit hinter der Mitte der Körperlänge beginnend. Ventrals vor der Mitte der Körperlänge eingelenkt.

"Grösste Körperhöhe c.  $3\frac{1}{2}$ - $3\frac{2}{3}$  mal, Kopflänge c.  $3\frac{1}{3}$ - $3\frac{1}{2}$  mal in der Körperlänge enthalten,<sup>14</sup> und der Schnauzenlänge bis zur Kinnschuppe gemessen wie der Stirnbreite gleich.

"Kopf nach vorne zugespitzt. Mundspalte sehr schräge gestellt, Unterkiefer nach vorne vorspringend. Kieferzähne einreihig, sehr klein, schlank und zahlreich. Knochen des Augenringes die niedrige Wangengegend vollkommen deckend.

"Dorsale nach oben zugespitzt, an Höhe etwas der Kopflänge nachstehend. Pectorale bis zur Basis der Ventrals zurückreichend, an Länge ein wenig geringer als die Höhe der Rückenflosse.

[P. 40.] "Ventrals mit ihrer Spitze den Beginn der Anale nahezu erreichend.

"Anale in ihrem vorderen Theile mässig lappenförmig erhöht.

"Schuppen klein, ziemlich festsitzend. Die Seitenlinie durchbohrt nur 4-6 Schuppen am Vorderrumpfe.

"Rumpf goldgelb. Humeralfleck ausnahmslos fehlend. Ein intensiv schwarz-violetter, häufig rhombenförmiger Fleck an und vor der Basis der Caudale, nach hinten über die mittleren Caudalstrahlen bis zu deren hinterem Rande sich fortsetzend.

<sup>14</sup> Evidently there is an omission here. Probably in the manuscript Dr. Steindachner had stated that the eye is contained so many times in the head, but the statement was omitted by the printer.

“Ein hellgelber Fleck am oberen und unteren Caudallappen unmittelbar hinter dem Caudalfleck. Ein gleichfalls intensiv violetter Streif am Bauch ein wenig hinter der Insertionsstelle der Ventralen beginnend und sich längs der ganzen Basis der Anale hinziehend. Ein Nebenast dieses Streifens zieht, ein wenig an Breite zunehmend (daher bindenähnlich), von der Basis der 3-4 ersten Analstrahlen schräge nach hinten und unten zum unteren Rande des 6. und 7. Analstrahles und bildet hierauf einen schmalen Saum am freien Rande der folgenden Analstrahlen.

“D. 9-10. A. 23. L. lat. c. 30. L. tr. 4/1/3.

“Zahlreiche Exemplare, nur bis zu 25-26 Mm. in der Totallänge, von Villa Bella (Amazonenstrom).”

### 13. *Aphyocharax agassizi* (Steindachner).

*Cheirodon agassizii* Steindachner, Flussf. Südam., Vol. IV, 1882, p. 38 (Jatuarana);

Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54.

*Aphyocharax agassizii* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293.

*Holoprion agassizii* Eigenmann, Smiths. Misc. Quarterly, Vol. XLV, 1903, p. 145;

Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

**Range:** Jatuarana, Amazon basin.

I have recognized no specimens of this species in the collections at my disposal and add the original description:

“Körperform sehr gestreckt. Seitenlinie unvollständig; ein bräunlichvioletter Fleck am vorderen Theile der oberen Höhenhälfte der Dorsale, höher als lang.

“Rücken- und Bauchlinie sehr schwach gebogen, erstere ein wenig rascher zur Dorsale ansteigend, als letztere bis zur Ventrale sich senkt. Dorsale in der Mitte der Körperlänge und nur wenig hinter der Basis der Ventralen in verticaler Richtung beginnend. Anale im vorderen Theile erhöht, lappenförmig über den Rest der Flosse vorragend. Humeralfleck sehr undeutlich; Caudalfleck fehlend, Kopflänge mehr als  $3\frac{1}{3}$ mal, grösste Rumpfhöhe 3mal in der Körperlänge.

“Augendiameter etwas weniger als 3mal, Stirnbreite  $3\frac{1}{2}$ mal, Schnauzenlänge gleichfalls  $3\frac{1}{2}$ mal in der Kopflänge enthalten. Kieferzähne zahlreich, schlank, verhältnissmässig sehr klein, spitz, mit kurzen Nebenzaeken, im Zwischenkiefer einreihig.

“Oberer Theil des Oberkiefers am ganzen vorderen Rande deutlich gezähnt.

“Obere Profillinie des Kopfes grade, nur wenig nach hinten ansteigend.

“Pectorale und Ventrale nach hinten zugespitzt; letztere überragt mit ihrer Spitze den Beginn der Anale bei einem Exemplare nicht unbedeutend, erstere erreicht nur die Basis der Ventralen.



"Dorsale an Höhe einer Kopflänge gleich, Ventrals um die Länge der Schnauze kürzer als der Kopf. Die Seitenlinie durchbohrt 7-8 Schuppen am Rumpfe.

"Der untere Rand der kurzen Analstrahlen ist dunkelvioletts gesäumt, und diese Färbung setzt sich strichförmig horizontal nach vorn fort, so dass der vordere erhöhte Theil der Anale durch diesen violetten Streif der Höhe nach halbirt erscheint. Der vordere lange Randstrahl der Anale (der dritte der ganzen Flosse) zeigt eine milchweisse Färbung.

"Rumpfseiten goldgelb, silbergraue Seitenbinde nicht scharf abgegrenzt.

"D. 11. A. 27. P. 13 (14). V. 8. L. lat. 30 (bis zur Caud.) L. tr. 5/1/3.

"Zwei Exemplare, jedes c. 40 mm. lang, von Jatuarana und ein Geschenk des Herrn Prof. L. Agassiz, dessen Andenken ich diese interessante Art widme."

#### 14. *Aphyocharax maxillaris* Ulrey.

*Aphyocharax maxillaris* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293 (Brazil).

*Holoprin maxillaris* Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

**Range:** Brazil, definite locality not known, probably from the lower Amazon. This species is known only from the types.

Head 3.5; depth 3-3.5; D. 11; A. 22-23, scales 6 + 24. Eye 2.33 in the head.

Snout very short, the maxillary extending beyond anterior margin of eye; premaxillary with about ten teeth, the median four three-pointed; mandible with a few conical teeth.

Origin of dorsal equidistant from tip of snout and base of caudal; pectorals reaching beyond origin of ventrals; the latter to the anal.

A small circular humeral spot, sometimes reduced to two or three color-cells. A large black spot on the upper half of the first dorsal rays, the tips of these rays white; a small black spot near tip of first few anal rays.

#### Genus V. *PRIONOBrama*<sup>15</sup> Fowler.

*Prionobrama* Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 534 (*madeira*).

*Bleptonema* Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (*paraguayensis*).

**Type:** *Prionobrama madeira* Fowler = *Aphyocharax filigerus* Cope.

General appearance of *Gephyrocharax*. Teeth tricuspid and conical in a single series on mandible, premaxillary, and along entire edge of maxillary; origin of

<sup>15</sup> *πριων* = a saw; *βράμα* = a bream.

dorsal behind the middle, about over the vertical from the origin of the anal; adipose fin well-developed; anal falcate, with fewer than forty rays, its origin nearer caudal than snout, first and second developed rays filigerous, curved; pectorals placed low, long and falcate, their margins nearly along the edge of the compressed belly when the fin is closed; caudal naked; lateral line incomplete; mouth very oblique; profile from tip of snout to near dorsal straight; two post-orbitals, similar to those in *Aphyocharax*, the lower large, the upper minute, sometimes a minute triangular wedge between the third suborbital and the postorbital, representing the lower postorbital of other genera; third suborbital covering the entire cheek; no well-defined pseudotympanum.

## KEY TO THE SPECIES OF PRIONOBAMA.

a. Lateral line 35-38; eight or nine scales between ventrals and dorsal; anal rays 29-34.

15. *paraguayensis* (Eigenmann).

aa. Lateral line 38-41; nine or ten scales between ventrals and dorsal; anal rays usually 32.

16. *filigera* (Cope).

15. *Prionobrama paraguayensis* (Eigenmann). (Plate IV, fig. 5.)

*Bleptonema paraguayensis* Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (Corumbá).

**Range:** Uruguay and Paraguay basins.

6884a-b, C. M., two, largest about 50 mm. Corumbá, May 9, 1909. Haseman.

6885a, C. M., one, about 42 mm. Puerto Suarez, May 6, 1909. Haseman.

6886a & b, C. M., two, largest 45 mm. Villa Hays, April 11, 1909. Haseman.

6887a-c, C. M., three, largest 42 mm. Asunción, March 29, 1909. Haseman.

6888a-j, C. M., ten, largest 49 mm. Arequa, April 8, 1909. Haseman.

847, M. C. Z., four, largest 35 mm. Uruguay River. Wyman.

5499, C. M., **type**, 40 mm. to base of caudal; 5499, C. M., **paratypes**, six, largest over 50 mm. Corumbá, April 27, 1909. Haseman.

Head 4.66-5; depth 3.33; D. 10, rarely 11; A. 29-34; lateral line 8 to 11 + 26 to 28 = 35 to 38; eight or nine scales between ventrals and dorsal; eye 3 in the head, about equal to interorbital.

Elongate, compressed, breast with a series of large median scales; belly between pectorals and ventrals trenchant, the margins of the scales of one side bent over the middle line, no median series of scales; predorsal with a median series of about sixteen scales, the series less regular near the occipital process, which extends about one-eighth of the way to the dorsal; skull smooth, convex, frontal fontanel large, triangular, a little more than half the length of the parietal;

second suborbital in contact with both the posterior and the lower limb of the preopercle; mouth very oblique, maxillary-premaxillary border a little more than orbital length; sixteen to twenty teeth on the maxillary, those on the posterior half larger, pointing backward and outward; seven premaxillary teeth; mandible with six or seven tricuspid teeth, the first and last distinctly larger than those between; in addition to these six or seven larger teeth several minute teeth appear posteriorly.

Origin of dorsal a little nearer to base of middle caudal rays than to the eye; origin of anal in front of or under the dorsal; first developed anal ray heavy and much prolonged, the second less so; outer ventral ray filiform; extending beyond the origin of the anal, pectorals to near middle of the ventrals; pectorals placed low, their base oblique, their shortest ray about one-half of the outer ray, which is similar to the outer ventral and first developed anal ray.

Scales everywhere regularly imbricate, with few radial striæ; a series of very small scales along the base of anal, caudal with a few scales at the base of the lobes; axillary scales small.

No definite markings, margin of anal in the male dusky.

16. *Prionobrama filigera* (Cope). (Plate IV, fig. 4.)

*Aphyocharax filigerus* Cope, Proc. Am. Philos. Soc., 1870, p. 564 (Pebas); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 55; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 334, fig. 23 (Pebas); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Paragoniates mülleri* Steindachner, Ichthyol. Beitr., Vol. V, 1876, p. 72 (Obidos).

*Prionobrama madeiræ* Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 534, fig. 9. (Tributary of Rio Madeira near Porto Velho, Brazil.)

*Bleptonema amazoni* Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (Santarem).

*Aphyocharax analis* Nichols, Bull. Am. Mus. Nat. Hist., Vol. XXXIV, 1915, p. 127 (Manaos).

**Range:** Amazons from Pebas to Villa Bella, Madeira basin.

5499a, C. M. **Type** of *amazoni*, 54 mm. 5599a-c, C. M., **paratypes**, 50-55 mm.

Santarem. Dec. 9, 1909. Haseman.

21188, M. C. Z.,<sup>16</sup> about 58 mm. Villa Bella, Jan. 1866. L. Agassiz.

21182, M. C. Z., twelve, largest 53 mm. Villa Bella, Jan. 1866. L. Agassiz.

21248, M. C. Z., seven, largest 51 mm. Iça. Jan. 1866. William James.

<sup>16</sup> Anal filament reaching to base of last anal ray. A. 30; l. l. 39.

- 21231, M. C. Z., two, larger 50 mm. Hyavary. D. Bourget.  
 21234, M. C. Z., twenty-one, largest 55 mm. Tabatinga. Bourget.  
 6889a, C. M., one, 50 mm. Santarem, Dec. 9, 1909. Haseman.  
 6890a-q, C. M., seventeen, largest 50 mm. Santarem, Dec. 15, 1909. Haseman.  
 6891a-n, C. M., fourteen, largest 60 mm. Villa Bella, Oct. 5, 1909. Haseman.  
 6892a-c, C. M., one, 54 mm. San Joaquin, Sept. 6, 1909. Haseman.  
 6923a, C. M., one, 50 mm. San Antonio de Rio Madeira, Nov. 3, 1909. Haseman.

This species is very similar to *paraguayensis*<sup>15</sup> ~~is~~ ~~ERRATA-~~

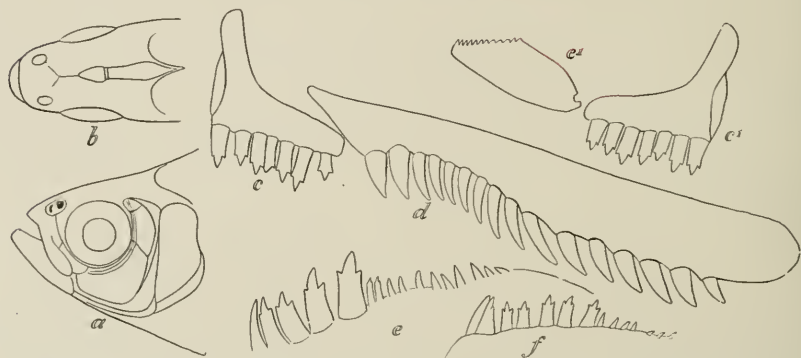


FIG. 11. *Prionobrama filigera* (Cope). *a*, side of head; *b*, top of head; *c*, *d*, *e*, the premaxillary, maxillary and portion of mandible; *c'*, premaxillary of the other side; *e'*, outline of entire mandible showing the extent of dentigerous portion, *f*, another mandible.

The scales are eight to fourteen (usually eleven) + twenty-six to thirty = thirty-eight to forty-one, nine or ten between ventrals and dorsal; the origin of the dorsal is equidistant from the base of the middle caudal rays and the anterior margin of the eye, above the origin of the anal.

|                        |     |     |     |     |     |    |
|------------------------|-----|-----|-----|-----|-----|----|
| Number of anal rays:   | 31, | 32, | 34, | 35, | 36, | 37 |
| Number of individuals: | 3   | 9   | 2   | 1   | 1   | 1  |

#### Genus VI. PARAGONIATES<sup>17</sup> Steindachner.

*Paragoniates* Steindachner, Ichthyol. Beitr., Vol. V, 1876, p. 69.

**Type:** *Paragoniates alburnus* Steindachner.

Teeth mostly tricuspid, the lateral cusps minute, very much smaller than the median cusp; teeth all in a single series, those of the premaxillary anteriorly

<sup>17</sup> παρά = besides; ἀγωνίατης, ὅ = a nervous person; *Agoniates*, a genus of fishes.

crowded, the second, and sometimes the fourth, more or less crowded out of line with the rest, suggesting an incipient second series; teeth along the entire edge of the maxillary. Origin of dorsal behind the middle; origin of anal about in the middle; adipose fin well-developed; anal fin without a lobe, its margin nearly straight; pectorals placed low, foliate, their margins nearly along edge of belly, when the fin is closed; caudal naked. Lateral line incomplete. Mouth large, oblique. Three postorbitals, covering entire postorbital area, the middle one the largest.

17. *Paragoniates alburnus* Steindachner. (Plate IV, fig. 2.)

*Paragoniates alburnus* Steindachner, Sb. Akad. Wiss. Wien, LXXIV, Ichthyol. Beitr., Vol. V, 1876, p. 69, pl. VIII, fig. 3 (Teffé); Boulenger, Proc. Zool. Soc., 1887, p. 281 (Canelos); Eigenmann, Report Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 441.

Range: Amazon basin above Teffé.

7315a-b, C. M., two, 70 and 86 mm. Villa Bella, Oct. 5, 1909. Haseman.

7316a, C. M., one, 73 mm. Santarem, Dec. 15, 1909. Haseman.

Steindachner's diagnosis of this species reads:

"Mundspalte sehr lang, hinteres Ende des vollständig bezähnten Oberkiefers bis hinter die Augenmitte bei geschlossenem Munde in verticaler Richtung sich erstreckend. Wangen vollständig von den Knochen des Suborbitalringes überdeckt. Körperhöhe 2-3/4mal, Kopflänge mehr als 4-1/3mal in der Körperlänge, Schnauzenlänge circa 3-2/3mal, Stirnbreite circa 3mal, Augendiameter circa 3mal, Länge der Mundspalte zwischen 1-3/4-1-4/5mal in der Kopflänge enthalten. Pectorale lang, über die Insertionsstelle der Ventrals, letztere über den Beginn der Anale zurückreichend. Fettflosse sehr klein; Dorsale in verticaler Richtung circa über dem 7. oder 8. Analstrahle beginnend. Seitenlinie noch vor dem Beginn der Anale endigend. Kiemenspalte lang; Verbindungshäute der Kiemenstrahlen mit dem Isthmus nicht verwachsen und unter der Kehle noch gespalten. Rechenzähne der Kiemerbogen schlank, locker gestellt. Ein grosser, nicht scharf ausgeprägter, bräunlicher Fleck am Schwanz."

Head 4.75; depth 3; D. 11; A. 44-48; scales 6 or 7-46-4 or 5, thirteen to seventeen with pores; eye a little greater than snout, 3 in the head, equal to, or a little less than, the interorbital; caudal peduncle deeper than long.

Compressed; the ventral profile nearly regularly arched from chin to end of anal; dorsal profile more gently and less regularly arched; preventral area compressed, trenchant, the scales of the two sides narrowly bent over the mid-ventral ridge; about twenty-nine predorsal scales; a regular median series extending from



the dorsal some distance forward, but the scales irregular anteriorly; occipital process short, only one-eighth of the distance from its base to the dorsal, bordered by three scales; frontal fontanel reaching at least to above the anterior margin of the pupil, entirely separating the frontals in the smaller specimen; snout pointed; the mouth large; maxillary slender, extending beyond the suture between the second and third suborbitals; premaxillary with seven teeth; maxillary with about twenty teeth along its entire edge, tricuspid in the largest specimen, in the smaller the upper ones similar to those of the premaxillary, the lower ones conical; dentary with seven to nine tricuspid teeth and about fourteen minute ones on the sides, conical in the smallest specimen, mainly tricuspid in the largest. Gill-rakers 7 + 11.

Origin of dorsal equidistant from tip of snout and a point beyond the tip of the middle caudal rays; height of dorsal about four times in the length; adipose fin small; caudal forked, the lobes 3.5-4 in the length; origin of anal equidistant from the base of the last ray and some portion of the eye; anal without indication of a lobe, its margin slightly convex or straight; ventrals reaching beyond origin of anal; pectorals beyond base of ventrals.

Lateral line developed on thirteen to seventeen scales; scales with one to four radial striæ; scales of the sides continued downward to form an anal sheath of from one to three series of scales free from the fin; scales on the end of the caudal peduncle irregularly arranged; caudal naked; a round or oval spot on the end of the caudal peduncle, not continued on the sides or on the fin. No other definite markings.

Genus VII. LEPTAGONIATES<sup>18</sup> Boulenger.

*Leptagoniates* Boulenger, Proc. Zool. Soc., 1887, p. 281.

**Type:** *Leptagoniates steindachneri* Boulenger.

Premaxillary, maxillary, and mandible with a single series of tricuspid teeth; origin of anal far in advance of origin of dorsal, equidistant from tip of snout and base of last dorsal ray; lateral line complete; adipose fin small.

I am in doubt whether in the final analysis this genus will remain associated with the Cheirodontinæ.

18. *Leptagoniates steindachneri* Boulenger. (Plate IV, fig. 3.)

*Leptagoniates steindachneri* Boulenger, *l. c.*, p. 281, pl. XXIII, fig. 3 (Sarayacu, Peru); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 441.

This species is known only from the type, 95 mm. long, in the British Museum. I append the description given by Boulenger, *l. c.*:

<sup>18</sup> λεπτός = thin; *Agoniates*, a genus of fishes.

"D. 10; A. 70; V. 8; P. 12; scales 7-47-7.

"The depth of the body is one-fourth of the total length (without caudal), the length of the head one-sixth. Mandible strongly projecting beyond the mouth; maxillary not reaching below the anterior border of the eye; premaxillary teeth 15, maxillary (on each side) 11, mandibular 14; mandibular teeth largest, maxillary smallest. The diameter of the eye equals nearly two-fifths the length of the head, and exceeds the width of the interorbital space. The pectoral fins reach nearly the extremity of the ventrals, which are small; the dorsal originates above the 23d anal ray. Colourless; sides of head and a lateral band above the lateral line silvery."

Genus VIII. PHANAGONIATES Eigenmann and Wilson.<sup>19</sup>

*Phanagoniates* Eigenmann & Wilson, Indiana University Studies, No. 19, 1914, p. 2.

**Type:** *Phanagoniates wilsoni* Eigenmann.

Mouth minute, teeth in a single series in each jaw, tricuspid, except in posterior part of maxillary, where they are conical, gill-opening wide, much compressed; chest not trenchant; pectorals large, reaching to middle of ventrals; anal very long, its origin far in advance of the dorsal; dorsal a little behind middle of body. No adipose fin, lateral line incomplete.

"19. *Phanagoniates macrolepis* (Meek & Hildebrand).

*Roeboides macrolepis* Meek & Hildebrand, Field Mus. Publ. Zool. Ser., vol. X, 1913, p. 84 (Rio Cupe, Boca de Cupe, Rio Tuyra).

5354, C. M., **type**, 41 mm.; **paratypes**, 13030, I. U. M. 7, 21-38 mm. Manigru.

Charles Wilson.

5355a, C. M., **paratype**, 30 mm. Certegui. Charles Wilson.

5356a, C. M., 13031, I. U. M., **paratypes**, 30 and 37 mm. Rio Truando.

Charles Wilson.

Head 4.6; depth 3.33; D. 9; A. 53-55. Scales 7-7 + 34-7 (9 + 35 in one), Eye 2.2 in the head.

Much compressed, dorsal profile highest at origin of dorsal, ventral profile deepest at origin of anal; preventral area rounded, without distinct median series of scales; occipital process about as broad as long; occipital fontanel much wider and twice as long as the parietal, cheeks narrow and long, entirely covered by the second suborbital; the mouth very small, the maxillary not reaching to the eye; lower jaw with nine teeth on each side, premaxillary with six, maxillary with eight,

<sup>19</sup> *φάνος* = bright. The name should have been printed *Phanagoniates* in my paper, Indiana University Studies, No. 19, and I herewith correct the spelling.

the first four tricuspid, the last four conical. The first four forming a continuous series with those of the premaxillary the four conical ones on the distally curved portion of the bone. Gill-rakers about  $5 + 8$ .

Scales thin, the margins obscure, a single row of scales along the base of the anal rays; a few scales along the base of the caudal lobes.

Origin of dorsal slightly behind the middle of body; height of dorsal equal to length of head; caudal lobes about equal to the height of the dorsal; origin of anal about equidistant from the snout and origin of its last third; ventrals small, reaching the anal; pectorals equal to the head less snout, reaching to middle of ventrals.

Translucent, a median dusky band along middle of caudal peduncle, fading out forward and continued narrowly on middle caudal rays; scales of back faintly marked with chromatophores, which become restricted to the margin of the scales on the upper part of the back. Chin and maxillary black, sometimes a dark streak back from upper part of gill-opening.

#### Genus IX. PARECBASIS<sup>20</sup> Eigenmann.

*Parecbasis* Eigenmann, Indiana University Studies, No. 20, 1914, p. 45.

**Type:** *Parecbasis cyclolepis* Eigenmann.

Teeth tricuspid, in a single series on anterior part of mandible and premaxillary, none on the maxillary or sides of the mandible; upper margin of the maxillary for its entire length heavy, then passing abruptly into a broad, thin, blade-like expanded portion extending to the convex free margin; sides of mandible raised; adipose fin well-developed; caudal partly scaled; lateral line complete. Origin of the dorsal in front of the middle. Cheeks entirely covered by the third sub-orbital, no apparent pseudotympanum; frontal fontanel very short.

#### 20. *Parecbasis cyclolepis* Eigenmann. (Plate V, fig. 2.)

*Parecbasis cyclolepis* Eigenmann, Indiana University Studies, No. 20, 1914, p. 45.

**Range:** Madeira and Amazons.

5495, C. M., **type**, 74 mm.; 5496, C. M., **paratype**, 80 mm. San Antonio de Rio Madeira, Nov. 3, 1909. Haseman. (Two other specimens from the same place taken by the same collector at the same time have been placed in exchange in the Museum of the Indiana University.)

6893a, C. M. 50 mm. to end of lateral line. Santarem, Dec. 9, 1909. Haseman.

6894a-c, C. M., 3, largest 78 mm., San Joaquin, Sept. 6, 1909. Haseman.

<sup>20</sup> παρὲς βασις, ἡ = a going out aside from.

Head 4; depth 2.75-3; D. 11; A. 24-26; scales 6 or 7-38 to 40-5; eye 2.75-3 + in the head, equal to interorbital.

Compressed, fusiform in outline, the dorsal and ventral outlines equally symmetrically curved; preventral area rounded, with a nearly complete median series of fourteen scales, predorsal area narrowly rounded with a median series of ten scales; occipital process bordered by four scales, extending one-fourth to dorsal; skull convex in cross-section; frontal fontanel 2.25 in the parietal; third suborbital in contact with both the vertical and horizontal limb of the preopercle, but leaving

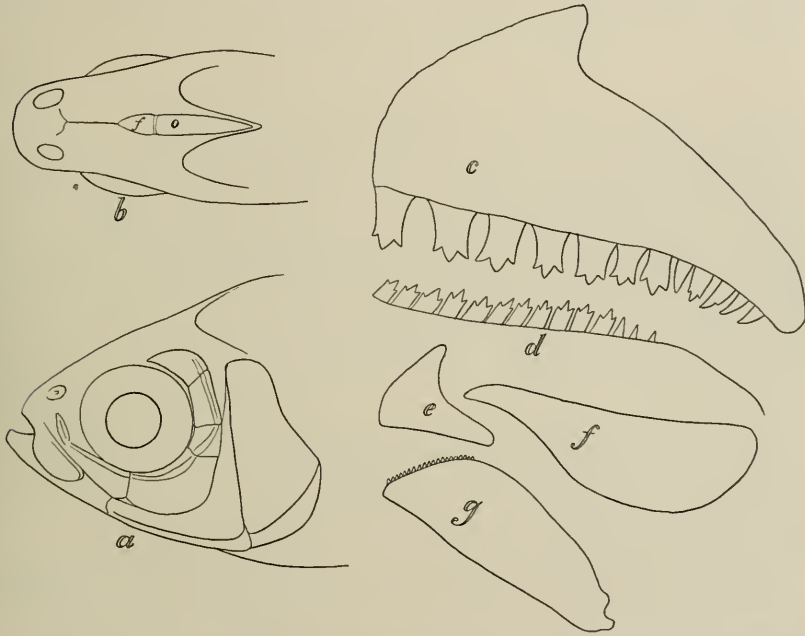


FIG. 12. *Paracbasis cyclolepis* Eigenmann. a, outline of head; b, outline of top of head, showing frontal (f) and occipital (o) fontanelles; c, premaxillary; d, dentary, teeth greatly enlarged; e, f, g, premaxillary, maxillary, and mandible in outline, moderately enlarged.

a narrow angle below its anterior edge; maxillary reaching to just below eye or not quite so far; mouth clupeoid, the premaxillary transverse, without an antero-posterior extent; teeth minute, confined to the premaxillary and but little more than the portion of the mandible in contact with it when the mouth is closed.

Origin of dorsal equidistant from tip of snout and end of adipose or a little nearer the latter; dorsal falcate, its highest ray exceeding length of head; anal

emarginate, its origin below some part of the last dorsal ray, its base greater than length of head; origin of ventral below origin of dorsal, just reaching anal, or a little shorter; pectorals short, just about reaching ventrals.

Scales thin, the margins convex, with many radial striæ; lateral line but little decurved; anal naked; caudal lobes scaled for one-fourth to one-third of their length.

A small, but conspicuous humeral spot, about equal to the size of the pupil, over the fourth scale of the lateral line; middle caudal rays faintly peppered, or a faint dusky streak parallel with the margin in the middle and the upper lobe of the caudal, the rays beyond them dotted.

Genus X. *LEPTOBRYCON*<sup>21</sup> gen. nov.

**Type:** *Leptobrycon jatuaranæ* Eigenmann.

Very similar to *Parecbasis*. Anal short, the highest ray, the fourth, extending beyond the tip of the last; lateral line short; mouth very large, the premaxillary very feeble, the maxillary very large, the upper margin thickened; lower jaw scoop-shaped, the sides raised; teeth numerous (fourteen in the premaxillary), feeble, conical, none on the maxillary, or on the raised part of the mandible; cheeks partly naked; postorbitals three, covering most of the postorbital area; no pseudo-tympanum; both fontanels large; adipose well-developed.

21. *Leptobrycon jatuaranæ* Eigenmann sp. nov. (Plate VI, fig. 1.)

20952, M. C. Z., **type**, 29 mm. to base of caudal. Jatuarana. Navez.

Head 3.75; depth 3.5; D. 11; A. 14; scales ?. Eye 2.5 in the head considerably larger than the interorbital; occipital reaching about one-sixth to the dorsal; frontal fontanel much narrower than the parietal, its length about 1.25 in the length of the parietal; interorbital nearly flat; maxillary very large, slightly longer than the eye, reaching to below the pupil, its front margin quite convex, its proximal margin slightly concave and thickened; premaxillary altogether transverse, each premaxillary with about fourteen minute, apparently conical teeth, without lateral notches. Mandible with minute teeth on its anterior edge, the side of the jaw upturned. Third suborbital narrowly in contact with the preopercle below. A small naked angle below its anterior edge. A narrow naked strip behind it. Gill-rakers 8 + 17, long and slender, the longest more than half length of eye.

Origin of dorsal equidistant from tip of snout and base of caudal; origin of anal behind the vertical from last dorsal ray; base of anal not much longer than eye,

<sup>21</sup> λεπτός, small, or delicate; *Brycon*, a related genus of the Characidae, from βρῖκω, to eat greedily.



its highest ray reaching beyond tip of last ray; ventrals reaching anal; pectorals small, not reaching ventrals, whose origin is below origin of dorsal. Scales with numerous parallel radial striæ; caudal naked, lateral line incomplete. Scales mostly lost.

Color uniform; a silvery lateral stripe.

This species is readily distinguished from *uruguayana* by its numerous teeth and the very short anal.

This specimen is very small and in bad repair, but its characters are so well marked that there will be no difficulty in recognizing the species.

#### Genus XI. APHYODITE<sup>22</sup> Eigenmann.

**Type:** *Aphyodite grammica* Eigenmann, Mem. Carn. Mus., Vol. V, 1912, p. 314.

Teeth minute, conical, or but feebly notched, seven on the premaxillary, fifteen or more on the mandible, none on the maxillary; premaxillary feeble, maxillary considerably larger, its outer margin convex; its inner margin concave and slightly thickened; sides of mandible much raised; adipose fin well developed; caudal lobes scaled to near their tips; cheeks covered by the third suborbital; postorbitals in three or four pieces, covering about half the width of the postorbital area, the tubes prominent; frontal fontanel about half as long as the parietal; no pseudotympanum; anal long.

Distinguished from the related genera, *Macropsobrycon*, *Megalamphodus*, and in fact from all the other genera of the subfamily by the scaled caudal.

#### 22. *Aphyodite grammica* Eigenmann.

*Aphyodite grammica* Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 314, Pl. XLIV, fig. 5 (Konawaruk).

**Range:** British Guiana.

1882, C. M., **type**, 32 mm.; 12162, I. U. M., **paratypes**, two, 30–32 mm. Konawaruk, Middle Essequibo, British Guiana.

Head 4.5; depth 3.33; D. 11; A. 22; scales 4–7 + 23–3. Eye twice as long as the snout, 2.5 in the head; interorbital a little less than the eye.

Compressed, slender. Head short, compressed, mouth small, oblique; the maxillary not reaching to below the eye, about two-thirds as long as eye; cheeks small, entirely covered by the suborbital below, a naked angle below its anterior margin and a naked border behind it; maxillary margin convex, with three scarcely perceptible teeth, or none. Anal emarginate; ventrals not reaching anal; pectorals

<sup>22</sup> ἀφύδη, a small fish; δῖτη with the force of *dile* in Aphrodite, i. e., born of, descended from.

not to ventrals. Scales of the back margined with dark; a black median line; some black at base of ventrals and base of anal.

Genus XII. *MACROPSOBRYCON*<sup>23</sup> gen. nov.

**Type:** *Macropsobrycon uruguayanae* Eigenmann.

Related to *Parecbasis*, but having even fainter dentition, and an incomplete lateral line; related to *Aphyodite*, but with a naked caudal and a well developed pseudotympanum; also to *Leptobrycon*, but with a long anal. It is possible that some of the species of *Megalamphodus* should be placed in this genus.

Teeth minute, conical, or but few of them with a lateral notch; six to eight in the premaxillary, five or six in the front part of the mandible, none on the side of the lower jaws, none on the maxillary, premaxillary feeble, maxillary several times as large, nearly as long as eye, its outer margin very convex, inner margin concave, not thickened; sides of mandible much raised; adipose fin well-developed; caudal apparently naked; cheeks entirely covered by the third suborbital; postorbitals covering about half the width of the postorbital space; frontal fontanel short or medium; a well marked pseudotympanum.

23. *Macropsobrycon uruguayanae*, sp. nov. (Plate VI, fig. 2.)

6895a, C. M., **type**, 46 mm., **paratypes** 6896a-d, C. M., four, about 45 mm.

Feb. 1, 1909. Haseman.

6897a, C. M., 26 mm. Uruguayana. Haseman.

Head 4.5; depth 3; D. 11; A. 23-25; scales about 30-33, of which about five are with pores. Eye 3 in head, greater than the very convex interorbital.

Dorsal and ventral profiles both regular, without humps or depressions, the ventral profile a little more arched than the dorsal; preventral area with about thirteen scales; predorsal area narrowly rounded with a median series of about thirteen scales. Occipital process reaching about one-sixth to one-seventh to the dorsal; frontal fontanel as broad, and less than half as long, as the parietal; the skull very convex, the third suborbital in contact with lower limb of the preopercle; without a naked angle under its anterior margin, leaving a wide naked wedge behind its posterior margin; postorbitals narrow and feeble, leaving about half of the postorbital area naked. Gill-rakers 7 + 15 to 17, very long and slender, the longest more than one-half the eye.

Premaxillary very feeble, one specimen examined has six slightly graduate conical teeth, of which only one has a slight notch on one side; another has seven

<sup>23</sup> *μάκροψ* with a long face, *i. e.*, maxillary.

teeth, none of which is notched, and still another has either five or six, none notched; mandibular teeth similar to the maxillary teeth and nearly of the same size.

Origin of dorsal very little nearer base of middle caudal rays than tip of snout; origin of anal under some part of the base of the dorsal, its base longer than head; ventrals just about reaching anal or not quite to anal; pectorals reach to the ventrals, which are inserted in advance of the vertical from front of dorsal.

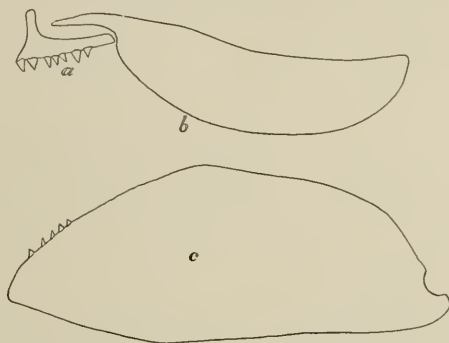


FIG. 13. *Macropsobrycon uruguayanae* Eigenmann. 6896 C.M., a, b, c, outlines of premaxillary, maxillary, and mandible.

Scales have been mostly lost, best preserved in smallest specimen; very regularly arranged, and apparently absent from caudal. Interhæmals of caudal peduncle few and feeble.

Color uniform, an ovate dark spot on middle caudal peduncle.

This species has the most feeble dentition of any of the members of the Cheirodontinæ; its conical teeth would place it outside this subfamily, but its relationships are unmistakable.

### Genus XIII. MEGALAMPHODUS<sup>24</sup> Eigenmann, gen. nov.

**Type:** *Megalamphodus megalopterus* Eigenmann.

Mouth large, teeth in part notched, in part conical, in a single series, seven to eleven on the premaxillary, two to twenty on the maxillary; four to eight tricuspid teeth along front of mandible, minute ones on the sides; all the teeth narrow and pointed, those of front of mandibles, most of those of premaxillary, and usually the upper ones of the maxillary, each with a minute notch on the sides, the rest conical; maxillary teeth few or along almost the entire edge; fontanels both very

<sup>24</sup> *μεγαλάμφοδος* = with spacious ways.

large, cheeks below the eye entirely covered, the part behind the eye mostly naked. Form compressed; fins large, origin of anal under dorsal; adipose fin well-developed, anal truncate or with a narrow lobe; caudal naked; lateral line incomplete; scales with a few diverging striae.

It is quite possible that the species here included in one genus should be distributed to other genera. It is certain that the species selected as the type is generically different from any of the other genera recognized in this paper. As stated above *melanotus* may belong to *Macropsobrycon*, with which the present genus is very closely related.\*

#### KEY TO THE SPECIES OF MEGALAMPHODUS.

- a.* Anal with a narrow lobe, 25-27; depth 2.2-2.4; fourth dorsal reaching caudal; a very conspicuous humeral bar; dorsal dark, without a distinct spot; about twenty maxillary teeth. . . 24. *megalopterus* Eigenmann.
- aa.* Anal truncate, the rays graduate; dorsal not falcate in the specimens examined. Maxillary with two to six teeth.
  - b.* A. 30; depth 2.5; a conspicuous humeral band; most of the dorsal black; anal margined with black. . . 25. *eques* Steindachner.
  - bb.* A. 25-28; depth 3.8; premaxillary with about twelve teeth; maxillary with about four teeth, its length equal to that of the eye; dorsal with a dark spot; a faint humeral spot and a faint caudal spot. . . 26. *melanotus* Eigenmann.
  - bbb.* A. 27-30; depth 3; no humeral spot; upper half of the first five developed rays of the dorsal black; six maxillary teeth. . . 27. *heteresthes* Urey.
  - bbbb.* A. 24-26; depth 2.4; sides uniformly dusted or with a narrow humeral bar; all but the first and the last three or four dorsal rays black; caudal and anal margined with black; maxillary with two to six teeth. . . 28. *micropterus* Eigenmann.

#### 24. *Megalamphodus megalopterus* Eigenmann sp. nov. (Plate VII.)

6806, C. M., **type**, 35 mm. 6807a-b, C. M., **paratypes**, 3, largest 34 mm. Caceres, May 23, 1909. Haseman.

Head 3.5; depth 2.2-2.4; D. 11; A. 25-27; lateral line 32-35, 4 to 6 scales with pores; eye 2.5, slightly greater than interorbital.

Greatly compressed, ventral outline regularly curved; dorsal outline steep to the dorsal, with a slight depression over the eye, base of dorsal very oblique; depth of caudal peduncle equal to its length; predorsal area narrow, with a regular series of nine or ten scales; preventral area broad, covered with two series of scales overlapping along the median line with an occasional scale at their angles. Fontanels both very large, anterior end of frontal fontanel equidistant from tip of snout and its posterior end; parietal fontanel much wider than the frontal; occipital process extending more than one-fourth to the dorsal. Mouth very oblique, maxillary as long as eye, reaching to suture between second and third suborbitals;

\* For additional species see Appendix to this article.

premaxillary and maxillary teeth of nearly the same size, about eleven on the premaxillary, about twenty on the maxillary, anterior mandibular teeth considerably larger; eight in front and minute ones on the side, third suborbital with a spur running up behind the eye; a wedge-shaped naked area behind it; post-orbitals obsolete; opercle emarginate above. Gill-rakers  $7 + 13$ , the longest about equal to the pupil.

Origin of dorsal a little nearer to tip of snout than base of caudal, the fourth ray highest, reaching to the middle of the caudal in the type; caudal forked, the lobes longer than head; origin of anal equidistant from base of middle caudal rays and the origin of the dorsal, below middle of dorsal as measured from tip of

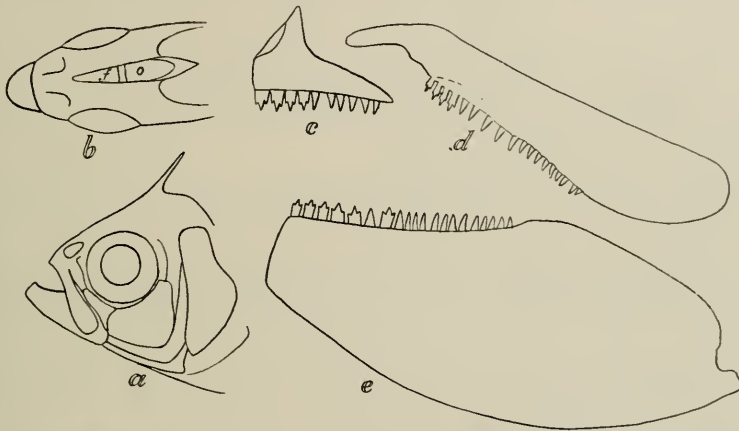


FIG. 14. *Megalampodus melanopterus* Eigenmann. 6807, C. M., a, side of head; b, top of head, showing frontal (f) and occipital (o) fontanelles; c, d, e, premaxillary, maxillary, and mandible, much enlarged. The relay teeth in the lower jaw are so numerous that they give the impression of a double row.

snout; anal with a narrow anterior lobe equal to length of head, the rays then of about equal length or decreasing but little to near the end where the fin is rounded; pectorals reaching beyond entire base of ventrals, ventrals to about the seventh anal ray.

Scales thin with few striæ and the rest of the sculpturing very weak; caudal and anal naked, a single series of scales along the base of the anal; pores developed on a very few scales; eleven scales between ventrals and dorsals.

A very conspicuous, large, humeral bar; dorsal and caudal of varying degrees of blackness. Anal dusky.



25. *Megalamphodus eques* (Steindachner).

*Cheirodon eques* Steindachner, Flussf. Süd-am., Vol. IV, 1882, p. 37 (Villa Bella; Obidos); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

**Range:** Amazon.

The following is the original description of this species by Steindachner:

“Seitenlinie unvollständig, nur 5–8 Schuppen im vorderen Theile des Rumpfes durchbohrend. Ein querbindenähnlicher, intensiv bräunlichschwarzer Fleck in der Humeralgegend. Ein eben so gefärbter grosser Fleck fast über die ganze Dorsale sich ausbreitend. Anale am ganzen unteren Rande bräunlich punktirt, wie braun gesäumt. Caudalfleck fehlend.

“Die Rückenlinie erhebt sich viel rascher zur Dorsale, als die Bauchlinie sich bis zur Ventrale senkt, und ist bei grösseren Exemplaren auch etwas stärker gebogen als die Bauchlinie. Hinter der Dorsale senkt sie sich minder rasch als die Bauchlinie längs der Analflossenbasis ansteigt.

“Die Dorsale beginnt in der Mitte der Körperlänge, hinter der Einlenkungsstelle der Ventralen in verticaler Richtung.

“Die grösste Rumpfhöhe ist  $2\frac{1}{2}$ mal, die Kopflänge 3mal in der Körperlänge, der Augendiameter  $2\frac{1}{2}$ mal, die Breite der querüber mässig gerundeten Stirne etwas mehr als 3mal in der Kopflänge enthalten und der Schnauzenlänge nachstehend.

“Der obere Theil des vorderen Oberkieferrandes ist, unter der Loupe betrachtet, fein gezähnt. Zwischenkieferzähne einreihig.

“Die Spitze der Ventralen reicht über den Beginn der Anale beträchtlich hinaus, und die der Pectoralen überragt gleichfalls ziemlich bedeutend die Insertionsstelle der Ventralen. Vom 4. oder 5. höchsten Strahle der Anale angefangen nehmen die folgenden Strahlen nur allmähig an Höhe ab, so dass diese Flosse im vorderen Theile nach unten keinen lappenförmigen Vorsprung zeigt.

“Die Höhe der Dorsale gleicht der Kopflänge mit Ausschluss der Schnauze, die Länge der Ventrale steht der Höhe der Dorsale circa um eine halbe Augenlänge nach.

“Rumpf goldgelb, mit zahllosen violetten Pünktchen übersät, die jedoch erst unter der Loupe deutlich unterschieden werden können. (P. 38.) Der Humeralfleck ist schräg gestellt, nach unten und vorn geneigt stets schmal, doch an Breite ein wenig variabel und zuweilen von einer hellen Zone nach vorn und hinten umgeben, scharf abgegrenzt und ausnahmslos tief schwarzbraun. Eine gleich intensive

Färbung zeigt der grosse runde Fleck auf der Dorsale. Längs der mittleren horizontalen Schuppenreihe des Rumpfes liefen bis zum Beginn der Caudale 33 Schuppen.

"D. 11. A. 30. L. lat. 33. L. tr.  $6\frac{1}{3}\frac{1}{2}$ ."

"Das grösste der von uns untersuchten Exemplare ist 30 mm. lang (mit Einschluss der Caudale).

"Fundort: Amazonenstrom bei Villa Bella und Obidos."

The lengths of the pectoral and ventrals, the shape of the anal, and the color make it very probable that *eques*, which I have not been able to examine in the new light of these studies, belongs to this genus.

#### 26. *Megalamphodus melanotus* (Eigenmann).

*Aphyocharax melanotus* Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 312 (Rockstone on the Essequibo River, British Guiana).

This species is known only from the specimens originally described.

1877a, C. M. Type, 43 mm. Rockstone sand-bank. Eigenmann.

Head 4; depth 3.8; D. 10; A. 25; scales 5-33-2, six with pores. Eye 2.75 in head, interorbital 3.75.

Compressed, preventral and predorsal areas rounded, the latter with a median series of ten scales.

Frontal fontanel not entirely separating the frontals; second suborbital in contact with the preopercle below, a very narrow naked area behind it.

Mouth large, the antero-posterior extent of the premaxillary very short; the maxillary large, with a curved anterior margin, its length about equal to that of the eye; about twelve teeth in each premaxillary; maxillary with about four similar teeth; about twenty teeth on each side of the lower jaw.

Origin of dorsal a little nearer snout than caudal; origin of anal under end of dorsal; ventrals not quite reaching anal, pectorals not quite to ventrals. Scales with a few divergent striæ. Pseudotympanum faintly evident on one side. Four chromatophores, tip of anterior dorsal rays dark.

#### 27. *Megalamphodus heteresthes* (Ulrey).

*Aphyocharax heteresthes* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293 (Brazil); Eigenmann, Report Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Brazil, definite localities not known.

Head 3.33; depth 3; D. 11; A. 27-30; scales about thirty-one. Eye twice the length of the snout, 3.5 in the head.

Maxillary teeth six or seven; premaxillary with six to eight conical teeth and two to four with lateral cusps; mandible with ten conical teeth and four with lateral cusps; maxillary extending considerably beyond the anterior margin of the eye.

Origin of dorsal midway between tip of snout and base of caudal. Pectorals

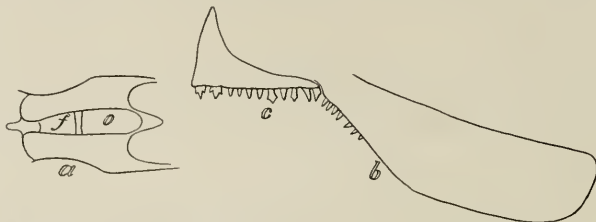


FIG. 15. *Megalamphodus heteresthes* (Ulrey), a, top of head, showing frontal (f) and occipital (o) fontanelles; b, maxillary; c, premaxillary.

extending beyond tips of the axillary scale; ventrals reaching anal; anal rays graduate.

No humeral or caudal spots, the upper half of the first developed rays of the dorsal black.

28. *Megalamphodus micropterus* sp. nov. (Plate VIII, fig. 1.)

6900a, C. M., type, 30 mm. 6901a-q, C. M., paratypes, seventeen, largest about 28 mm. Lagoa do Porto, Dec. 24, 1907. Haseman.

6904a, C. M., paratype, one, 27 mm. Rio Salitre. Haseman.

6902a-i, C. M., paratypes, nine, largest 30 mm. Santa Rita, Jan. 24, 1908. Haseman.

6903, C. M., paratypes, thirty-five, largest 32 mm. Pirapora, Dec. 14, 1907. Haseman.

6905a-d, C. M., four in bad state. Boqueirão near mouth of Rio Preto.

This species from the basin of the Rio San Francisco is similar to *eques*, from which it differs at least in the number of anal rays.

Head 3.4; depth 2.4-2.75; D. 11; A. 24-26; scales 5 to 7 + 24 to 27. Eye 2.5, much larger than the interorbital.

Similar to *M. megalopterus* in shape, the back not quite so elevated; predorsal area with nine or ten scales.

Mouth large, the maxillary not quite as long as the eye, not reaching to suture between the second and third suborbitals; premaxillary with seven to nine teeth, of which one or two may be conical, the rest tricuspid; maxillary with two to six

teeth, of which one or more may be conical; mandible with seven or eight tricuspid and five to nine conical teeth; occasionally one of the premaxillary teeth is placed a little in front of the line of the others, suggesting *Hyphessobrycon*; second sub-orbital leaving only a narrow naked wedge behind it; postorbitals very feeble. Gill-rakers 5 + 13.

Origin of dorsal equidistant from tip of snout and base of caudal; dorsal



FIG. 16. *Megalamphodus micropterus* Eigenmann. a, side of head; b, top of head, showing frontal (f) and occipital (o) fontanelles; c, d, e, premaxillary, maxillary, and mandible of a specimen, 6903, C. M., greatly enlarged; f, outline of entire mandible; g, portion of a maxillary; h, i, j, k, premaxillaries showing the teeth. In fig. h there is at x a tooth out of line, forming an incipient second series.

pointed, its highest rays, second to fourth, not quite equal to the head in length; caudal lobes not quite equal to the length of the head; origin of anal under middle of dorsal; margin of anal truncate, the rays slightly graduate, no lobe, the highest ray equal to snout and eye; ventrals reaching nearly to, or a little beyond, origin of anal, pectorals to beyond base of ventrals; males with hooks on the third to sixteenth anal rays.

Scales thin with a few divergent radial striæ; caudal and anal naked.

Sides (in males?) uniformly dusted, or (in females?) with a distinct humeral band; all but first and last three or four dorsal rays black; caudal and anal margined with black; ventrals and pectorals sometimes tipped with dark.

Genus XIV. *MICROSCHEMBRYCON*<sup>25</sup> gen. nov.

**Type:** *Microschemobrycon guaporensis* Eigenmann.

General appearance of *Aphyocharax*, the lateral line complete to within four scales of the caudal; three postorbitals, of which the middle one is largest, covering most of the postorbital area; cheeks covered by the third suborbital; maxillary slender, the teeth much crowded, and on less than one-third of its length; teeth narrow, minute, crowded; no pseudotympanum; frontal fontanel moderate; adipose fin moderate; anal base long.

29. *Microschemobrycon guaporensis*, sp. nov. (Plate VIII, fig. 2.)

6910a, C. M., **type**, about 37 mm. (30.5 to base of caudal). Maciél, Rio Guaporé, July 23, 1909. Haseman.

Head 4; depth 4; D. 11; A. 22; scales 4-33-3, twenty-nine or thirty scales with pores; eye 2.75 in the head, snout 3.4, interorbital 3.

About twelve preventral scales, about nine predorsal scales, occipital process reaching about one-sixth to the dorsal; frontal fontanel not quite 2 in the parietal, its anterior end a little in front of the middle of the eye; mouth large, maxillary-premaxillary border 2.75 in the head; maxillary not nearly reaching third suborbital; teeth all minute, those on the mandible conical, with a minute lateral notch, those on the premaxillary broader; twelve teeth on the premaxillary, twelve on the maxillary on less than one-third its length; twenty-five or more on the mandible. Postorbitals in three pieces, the upper and lower ones minute, the middle one high, less strongly developed than in *Aphyocharax*.

Gill-rakers 6 + 11, long, 2.5 in the eye.

Origin of dorsal a little nearer snout than base of caudal; origin of anal under end of dorsal; ventrals almost reaching anal, pectorals not quite to anal.

Scales well imbricate, firm, without radial striæ; caudal and anal naked.

A series of dots from between the ventrals to the base of the anal and along the root of the anal; some chromatophores on the bases of the caudal rays.

Genus XV. *OLIGOBRYCON*<sup>26</sup> gen. nov.

**Type:** *Oligobrycon microstomus* Eigenmann.

Teeth heavy, tricuspid, in a single series, very few in number (four on the premaxillary); the maxillary not reaching anterior margin of orbit; the eight teeth of the two premaxillaries in a very shallow crescent, maxillary with one to two teeth;

<sup>25</sup> μικρόσχημος = small of stature.

<sup>26</sup> ὀλίγος = small; *Brycon*, a genus of fishes.



cheeks with a very narrow naked margin; three postorbitals; lateral line incomplete; scales with few divergent radial striæ; caudal naked; adipose well-developed. Interhæmals not evident; no pseudotympanum.

This genus differs from *Aphyocharax* and from *Mixobrycon ribeiroi* in dentition, the size of the mouth, the armature of the cheeks, etc.

30. *Oligobrycon microstomus* sp. nov. (Plate IX, fig. 1.)

6898a, C. M., type, 39 mm.; 6899a, C. M., paratype, 27 mm. Jacarehy, Rio Parahyba, July 15, 1908. Haseman.

Very similar in shape, size of mouth, and general appearance to *Cheirodon interruptus*.

Head 3.5; depth 2.3–2.6; D. 11; A. 24 or 25; scales 7 or 8 + 25, twelve scales



FIG. 17. *Oligobrycon microstomus* Eigenmann. 6699, C. M. a, outline of top of head; b, c, d, premaxillary, maxillary, and mandible enlarged; e, dentition of specimen 6898, C. M.; f, suborbitals and postorbitals of 6699, C.M.

between dorsal and ventrals; eye three times in the head, a little less than interorbital; caudal peduncle as deep as long; base of anal a little longer than head.

Very deep and compressed; dorsal and ventral profiles nearly equally arched; preventral area rounded, without a definite median series of scales; predorsal area with a blunt keel; about eight scales in a median series from the dorsal forward

and three overlapping rows of scales between these and the occipital process; occipital process extending about one-fifth to dorsal, bordered by three scales; frontal fontanel long, pointed, about one-half as long as the parietal with its groove; interorbital nearly flat, very broad; snout blunt, face of maxillary nearly vertical; margin of second suborbital convex, leaving a narrow naked margin of nearly equal width around its entire margin; postorbitals strong, leaving a narrow naked margin; mouth minute; maxillary very broad and short, not reaching to below eye, a little more than half as long as eye; maxillary-premaxillary border about three-fourths as long as eye. Maxillary with one or two minute teeth; premaxillary with four graduate teeth; mandible with six graduate teeth. Gill-rakers 5 + 8, short.

Origin of dorsal equidistant from tip of snout and base of caudal or a little nearer the latter, its height equal to length of head to upper angle of gill-opening; origin of anal under middle or behind middle of dorsal; ventrals just reaching anal; pectorals reaching to ventrals.

Scales very regularly imbricate, those of the belly with many sub-parallel radial striæ, those of the sides with divergent striæ.

A vertical humeral bar crossing the third and fourth scales of the lateral line; an oval spot on the end of the caudal peduncle; region between nape, dorsal, and anal nearly evenly peppered; region forward of a line joining base of ventrals and the humeral spot silvery.

#### Genus XV. *APHYOCHEIRODON*<sup>27</sup> gen. nov.

**Type:** *Aphyocheiroduon hemigrammus* Eigenmann.

Teeth notched, in a single series, those in the maxillary and premaxillary narrow, with nearly parallel edges, and with three or five cusps, the median one prominent, the lateral ones small; premaxillary teeth about eight to ten in number; maxillary teeth four or five on the upper fourth of the edge of the maxillary. Mandibular teeth much expanded at tip, the margins of neighboring teeth in contact, the tip chisel-shaped, divided into three lobes of equal size, a minute cusp on each side. Mouth large; cheeks partly naked; frontal fontanel very short; adipose fin well developed; caudal naked; lateral line incomplete; scales with a few diverging radial striæ; no pseudotympanum.

It is very probable that there is but little difference between the sexes, the caudal fulera being normal. Only one species is thus far known.

<sup>27</sup> ἀφίη = a small fish; *Cheirodon*, a genus of this subfamily of fishes.

31. *Aphyocheirodon hemigrammus* sp. nov. (Plate IX, fig. 2.)6802, C. M., **type**, 45 mm. 6803, C. M., **paratypes**, twenty-six, largest 48 mm.

Jaquara, Aug. 18, 1908. Haseman.

6804a-d, C. M., **paratypes**, four; largest 45 mm., Mogy Guassú, Aug. 25, 1908. Haseman.6805a, C. M., **paratype**, one, 39 mm. Riberão Azul, 12 miles from Tieté, Oct. 7, 1908. Haseman.**Range:** Tieté basin, Jaquara.

Head 4; depth about 3; D. 11 rarely 10; A. 23-25 (27 in one); scales usually 34, more rarely 36 or 37; eye 2.5-3 in the head, about equal to the interorbital.

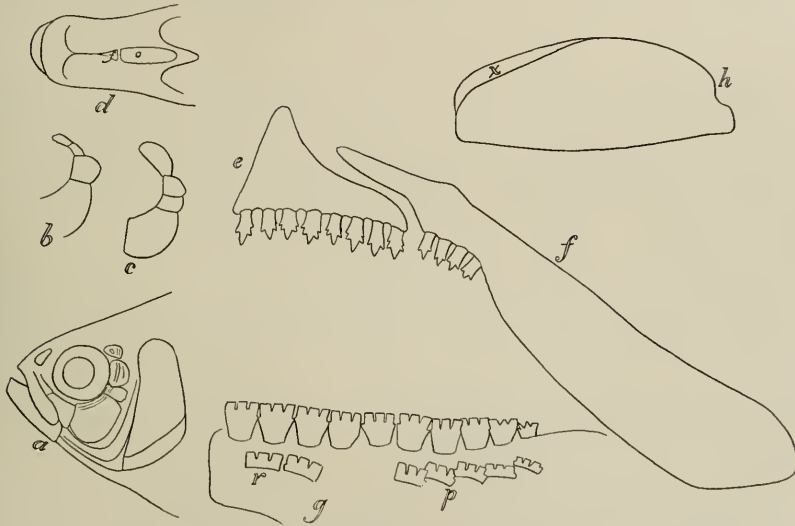


FIG. 18. *Aphyocheirodon hemigrammus* Eigenmann. a, outline of head; b, c, variations in the post-orbitals; d, top of head, to show form and location of the fontanels; e, premaxillary; f, maxillary; g, mandible, showing relay teeth at r and p; h, outline of entire mandible, showing teeth-bearing portion at x. (All figures much enlarged.)

Compressed, elongate, dorsal and ventral profiles nearly equally arched; pre-ventral area rounded; sometimes a nearly regular median series of twelve scales, sometimes the scales irregular; postventral area rounded; predorsal area rounded, with a median series of about twelve scales; occipital process bordered by two or three scales reaching one-seventh to the dorsal; skull convex above; frontal fontanel very small, the frontals sometimes mesially in contact with the bridge;

parietal fontanel very large; mouth large, the maxillary equal to the eye, not quite reaching the suture between the second and third suborbitals. Third suborbital leaving a naked area around its entire convex free margin; a naked area about half as wide as the postorbital behind the postorbitals. The postorbitals in two or three parts, very variable. Gill-rakers  $4 + 10$ , longest about half the length of the eye.

Premaxillary teeth eight to ten, of nearly uniform size, their margins subparallel, the median cusp more prominent than the lateral; maxillary teeth similar, but smaller than the premaxillary teeth, and with three cusps. Mandibular teeth graduated on the side of the jaw, the anterior six or seven of about equal size, their tips broad, the bases narrowed, the three median points alike, forming a continuous cutting edge, the expanded tips of the teeth being in contact, a minute cusp on each side.

Origin of dorsal equidistant from tip of snout and end of middle series of scales, the dorsal pointed, its height about equal to the length of the head; adipose fin well developed; caudal lobes about equal to length of the head; origin of anal below middle or posterior part of dorsal, its margin distinctly emarginate, the height of the lobe less than the length of the head; ventrals reaching anal; pectorals reaching ventrals.

Scales with a varying number of radiating striæ, everywhere regularly imbricate; caudal naked; no distinct row of scales along the base of the anal; axillary scale very small; eight to ten scales with pores; ten scales between dorsal and ventrals.

A conspicuous black spot occupies the entire width of the caudal peduncle and half the length of the middle caudal rays. A median dusky line associated with a narrow silvery line on posterior half of body. No other markings.

Male scarcely distinguishable from the female, lower caudal fulera not modified.

#### Genus XVI. COMPSURA<sup>23</sup> gen. nov.

**Type:** *Compsura heterura* Eigenmann.

Closely allied to *Cheirodon*, but differing much in the structure of the male.

Teeth few; multicuspid incisors in a single series; mouth minute; second suborbital in contact with the preopercle below and partly behind; postorbital leaving a naked area behind about half as wide as the bone; adipose fin well-developed; caudal fulera in both sexes covered by scales; a lobe of large scales in the male extending along the base of the middle caudal rays; lateral line incomplete; scales

<sup>23</sup> κομψός = well dressed; ουρά = tail.

with a few diverging striæ. All but the three or four last of the divided anal rays of the male with hooks.

32. *Compsura heterura* sp. nov. (Plate X, fig. 1.)

6808, C. M., type ♂, 36 mm. 6809a-k, C. M., paratypes, five males and eight females, largest 37 mm. Queimadas, Rio Itapicuru, March 2, 1908. Haseman.

6810a, C. M., ♂, 31 mm. Barreiras, Lagoa of Rio Grande of Rio San Francisco, Jan. 3 and 4, 1907. Haseman.

6811a-c, C. M., ♂, 32 mm. Santa Rita, Jan. 24, 1908. Haseman.

Range: Rio San Francisco and Rio Itapicuru.

This species with the general appearance of a *Cheirodon* can readily be dis-

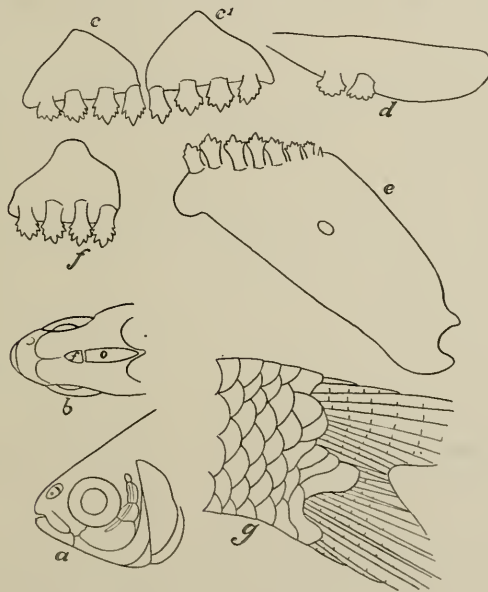


FIG. 19. *Compsura heterura* Eigenmann. a, outline of side of head; b, top of head, showing frontal (f) and parietal, or occipital (o) fontanels; c, c', right and left premaxillaries; d, maxillary, e, mandible of an individual, 6809, C. M., greatly enlarged; f, premaxillary of another individual; g, scaling of the tail of a male, 6808, C. M. (All figures greatly enlarged.)

tinguished by the black upper half of the first dorsal membrane together with the black tip of the dorsal.



Head 4-4.25; depth 2.5-2.75; D. 10 or 11; A. most frequently 19, ranging from 17-20; scales 34-35, rarely 32, eight or nine scales with pores, ten scales between dorsal and ventral; eye 2.6-3 in head, about equal to the interorbital; depth of caudal peduncle about equal to its length.

Compressed, dorsal and ventral outlines evenly and equally curved. Pre-ventral area rounded with a median series of eleven scales; predorsal area rounded with a median series of nine scales, extending to within two scales of the occipital process; occipital process broad and short, reaching about one-seventh to the dorsal, bordered by two and one-half scales on each side; skull convex, frontal fontanel only about one-fourth as long as the parietal; mouth very short and small, maxillary very little, if any, more than half as long as the eye; teeth broad-tipped, five- or seven-pointed, median point largest, projecting; four teeth on the premaxillary, two on the maxillary, eight or nine on the mandible, those on the side of the mandible graduate, the last one may be minute and single pointed, all the rest of the teeth similar in size and shape; third suborbital strong, in contact with the preopercle below and partly behind; postorbitals thin, ill defined, leaving a considerable naked area. Gill-rakers 4 + 8, very short, only about one-fifth as long as eye.

Origin of dorsal a little nearer tip of snout than base of caudal, the fin pointed, the highest ray about equal to the head; adipose fin small; caudal forked, the lobes about equal to the length of the head; origin of anal behind the vertical from the last dorsal ray; anal fin but slightly emarginate, its base little shorter than the head; all but the last three or four of the divided anal rays of the male with seven or eight strong recurved hooks. Pectorals of the male reaching the ventrals; ventrals of the male truncate, reaching the anal, ventrals of the female pointed, not reaching the anal; the pectorals in the female not reaching the ventrals.

Scales thin, regularly imbricate, very few diverging striæ; anal with about three scales forming a sheath at the base of the anal; base of caudal in the male scaled, the scales covering the caudal fulcrum and forming a lobe along the middle of the fin.

Tip of dorsal and upper part of membrane between the rudimentary and first full ray black; tip of anal in the male black; a conspicuous triangular caudal spot not quite extending to the end of the middle rays; a black band extending forward to below the dorsal.

Genus XVIII. MIXOBRYCON<sup>29</sup> gen. nov.

**Type:** *Mixobrycon ribeiroi* (Eigenmann).

Closely resembling *Hyphessobrycon*; teeth heavy, few, in a single series; third

<sup>29</sup> μίξις = a mixing; *Brycon*, a genus of Characins. Name chosen because the teeth show some of the characters of *Hyphessobrycon*.

suborbital with a wide naked area around its entire border. Postorbital covering nearly the entire postorbital space. Mouth moderate, the maxillary not reaching to the end of the second suborbital; adipose fin well developed; caudal naked; lateral line short; frontal fontanel large, entirely separating the frontals; no pseudotympanum; no prominent interhæmals.

33. *Mixobrycon ribeiroi* (Eigenmann). (Plate X, fig. 2.)

*Cheirodon ribeiroi* Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9; Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429.  
10229, I. U. M., one, type, 35 mm. to base of caudal. Puerto Max, Paraguay, J. D. Anisits.

This species is known only from the type.

Head 3.4; depth 3; D. 11; A. 26; scales 5-33-4, seven scales with pores. Eye 2.5 in the head, greater than interorbital.

Compressed, elongate; preventral area rounded; predorsal area rounded, with a median series of eleven scales; occipital process elongate, pointed, reaching one-



FIG. 20. Dentition of *Mixobrycon ribeiroi* Eigenmann.

fifth to dorsal, bordered by three scales on each side; frontal fontanel long, pointed, 1.5 in the parietal; maxillary long, slender, nearly three-fourths as long as eye; premaxillary with four large, heavy teeth; the second tooth largest, with seven points, the middle point of which is the largest, the base of the tooth much narrower than the tip; the second to fourth teeth graduate; no teeth on the maxillary; mandible with four, heavy, five-pointed, graduate teeth; teeth of side of jaw lost or absent; second suborbital with a wide naked area around its entire margin. Gill-rakers 7 + 11, the longest about one-third as long as eye.

Origin of dorsal very nearly equidistant from tip of snout and caudal; origin of anal under back part of dorsal; only one interhæmal (or none?) on the caudal peduncle; pectorals reaching ventrals, the latter not to anal; adipose fin well-developed.

A large humeral spot over third to fifth scales of lateral line; a dark line from upper part of humeral spot to middle of caudal; caudal spot extending across the entire caudal peduncle, and on middle caudal rays.

Named in honor of Dr. Alipio de Miranda Ribeiro of Rio de Janeiro.

Genus XIX. CHEIRODON<sup>30</sup> Girard.

*Cheirodon* Girard, Proc. Acad. Nat. Sci. Phila., Vol. VII, 1854, p. 199.

**Type:** *Cheirodon pisciculus* Girard.

Minute fishes ranging from 25 to 60 mm. in length; teeth of the upper and lower jaws similar, with five or more points; usually the tips of the teeth are expanded, more rarely the margins of the teeth are nearly parallel, arranged in a single series; one to three teeth on the maxillary, four to nine teeth on the premaxillary (most frequently five); cheeks usually nearly completely covered by the third suborbital, but with a naked area around its entire border in *C. annæ*; the origin of the dorsal very nearly equidistant from tip of snout and base of middle caudal rays; adipose fin well-developed; origin of anal about under the last dorsal ray; a variable number of the anal rays and sometimes the ventral rays in the males with numerous hooks, the base of the hook-bearing portion of the anal not infrequently at an angle with the base of the normal portion; interhæmal spines of the caudal peduncle variable, those of the male strong, protruding, sometimes ankylosed and sometimes with broad wing-like lateral processes. Scales thin, regularly imbricate, with a variable number of radial striæ. Caudal naked, anal with a few scales in a single series at the base of the anterior rays; scales moderate, between thirty to thirty-six in the lateral series, of which not more than twelve have pores. No humeral spot, the covering of the anterior air-bladder very thin, in a triangular pseudotympanum; usually a conspicuous caudal spot, more rarely a dorsal spot.

**Range:** Amazons, Panama, eastern slope of Colombia, south to the Rio San Francisco, Rio Parahyba, Rio Grande do Sul, and the La Plata basin; western slope of Chili.

No specimens of *Cheirodon pisciculus* are at hand. It is possible that the specimens of *Cheirodon annæ*, listed below, the origin of which is unknown, are in reality the types of *Cheirodon pisciculus*. If so, then the species listed after *C. annæ* are representatives of a genus distinct from *Cheirodon*. If, however, *Cheirodon pisciculus* is distinct from *C. annæ* and agrees with the species which here succeed it, then *C. annæ* should be made the type of a distinct genus. *C. annæ* certainly is not congeneric with the other species of *Cheirodon* here figured. *C. microdon* and

<sup>30</sup> χείρ, ἡ = hand; ὀδών, ὁ = tooth.

*C. stenodon* are also quite distinct from the rest of the species. This is the only genus of Characins reaching the Pacific slope of Chili, where at Puerto Montt it also attains the southernmost latitude recorded for the Characins.

## KEY TO THE SPECIES OF CHEIRODON.

- a. A naked area about the entire distal margin of the third suborbital, very wide behind it; elongate, depth 3 or more in the length; mouth moderate; teeth broad-tipped with narrow bases; anal short, 12-15, the tip of the first developed ray extending beyond the tip of the last; caudal peduncle slender, about twice as long as deep. (Not examined in *C. pisciculus*.)
  - b. Maxillary with two teeth.....34. *pisciculus* Girard.
  - bb. Maxillary with one tooth.....35. *annæ* McAtee.
- aa. Second suborbital in contact with the preopercle at least below; anal emarginate 17-27.
  - c. Mouth minute or moderate; teeth broad-tipped.
    - d. Fifteen to twenty interhæmals;<sup>31</sup> extending from near base of last anal ray to caudal, with broad, wing-like lateral processes in the male; a naked area along the entire posterior edge of the third suborbital.
      - e. Three, more rarely two, maxillary teeth; maxillary very little more than half the length of the eye, its margin straight; premaxillary with five teeth; A. 18-19; eighteen to twenty-three interhæmals from near base or behind tip of last anal to caudal; base of anal equals length of caudal peduncle; largest about 25 mm.....36. *insignis* Steindachner.
      - ee. Two maxillary teeth; maxillary about half the length of the eye, its margin but little curved; premaxillary with four teeth; A. 19-24; fifteen to twenty interhæmals, extending from near base of last anal ray to caudal; base of anal much longer than caudal peduncle. Length of largest recorded specimen 39 mm.....37. *parahybæ* Eigenmann.
      - eee. One maxillary tooth; maxillary about half the length of the eye, its margin strongly convex; premaxillary with four or five teeth; A. 17-24; twenty or more interhæmals; extending from near base of last anal ray to caudal. Largest recorded specimen, 60 mm.
        - 38. *interruptus* Jenyns.
        - 39. *monodon* Cope.
        - 40. *ibicuhiensis* Eigenmann.
    - dd. Eight to thirteen interhæmals extending from near tip of last anal ray to caudal; base of anal equals caudal peduncle and middle caudal rays; maxillary scarcely reaching eye; cheeks with a naked wedge behind the second suborbital.
      - f. Dorsal with black spot along the base of the anterior rays; A. 20-22; scales 32-34; premaxillary with four teeth, maxillary with two; a spot across the entire caudal peduncle.
        - 41. *notomelas* Eigenmann.
      - ff. Dorsal without a distinct black spot.
        - g. No caudal spot or other definite markings; premaxillary with five teeth; maxillary with two; about nine weak interhæmals. A. 23; scales 36.....42. *madeiræ* Eigenmann.
        - gg. A large conspicuous caudal spot sometimes continued to the end of the middle rays.
          - h. Anal plain; scales 31-36; premaxillary with four or five teeth, maxillary usually with two; nine to thirteen interhæmals, occupying half the distance between the anal and caudal; A. 19-27.....43. *piaba* Lütken.
    - ec. Mouth moderate; teeth in premaxillary narrow, five to nine in number; maxillary teeth two-thirds to

<sup>31</sup> See also *insignis*, in which there may be only eight.



three-fourths as long as eye; dorsal with some black; depth 2.8-3; interhæmals of caudal peduncle feeble; third suborbital leaving only a naked wedge behind it.

- i. Three median points of teeth of mandible equal in size; seven to nine teeth in premaxillary; depth 2.8; A. 23-35; maxillary three-fourths as long as eye; seven to nine teeth in premaxillary, two in maxillary. Scales 34-36. ....44. *microdon* Eigenmann.
- ii. Teeth of lower jaw similar to those of upper, but a little wider, one large median point and two small points on each side; five to seven teeth in premaxillary, two teeth in maxillary; depth 3; A. 18-22; maxillary two-thirds in eye; scales thirty-six or thirty-seven. ....45. *stenodon* Eigenmann.

### 34. *Cheirodon pisciculus* Girard. (Plate XVII, fig. 4.)

*Cheirodon pisciculus* Girard, Proc. Acad. Nat. Sci. Phila., 1854, p. 199; U. S. Nav. Astronom. Exped., Fishes, 1855, p. 249, pl. 34, figs. 4 and 7 (Santiago, Chili); Eigenmann and Eigenmann, U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Chirodon pisciculus* Günther, Cat. Fish. Brit. Mus., Vol. V, 1864, p. 332; Steindachner, Zool. Jahrbuch., Suppl. IV, 1898, p. 328 (Llanquihue, near Puerto Montt, Chili).

**Range:** Southern Chili.

I have seen no specimens of this species. The following is an abridgment of Girard's description:

Head 4; depth 3-4; D. 10; A. 14. Eye 3 in the length of the head; depth of caudal peduncle 2.5 in the greatest depth.

Snout short and rounded; eye rather large. Maxillary teeth very small and few. Dorsal fin higher than long. Caudal forked. Anal nearly as deep as long. Ventrals and pectorals slender. Scales proportionately very large, higher than long. A silvery band along the middle of the flanks, margined above with black. Fins unicolor, olivaceous.

A small fish of a rather short appearance, in spite of the slenderness of the peduncle of the tail. Dorsal and ventral lines equally arched. Body very much compressed; mouth small and slightly oblique; maxillary extending to a vertical line immediately in advance of the anterior rim of eye when the mouth is closed. Dentary teeth much larger than those on the intermaxillaries. Their form is flattened, dilated towards their upper edges, which are provided generally with five subconical points, the middle one being the longest, giving them the appearance of digits.

Origin of dorsal nearer base of caudal than tip of snout; dorsal much higher than long, its upper edge rounded or subconvex. The adipose is slender, nearer to the base of the caudal than to the posterior edge of the dorsal and consequently



situated behind the anal. The anal longer than the dorsal, and nearly as long as deep; its exterior edge convex anteriorly, and subconvex posteriorly. Its anterior margin is situated backwards of the posterior edge of the dorsal.

The caudal fin, which constitutes about one-fifth of the total length, is deeply forked posteriorly; its lobes are rather round and only acute at their extremities. The insertion of the ventrals is on the middle of the abdomen, somewhat in advance of the anterior margin of the dorsal. These fins are rather slender, with their tips acute and reaching the vent. The origin of the pectorals is situated near the inferior region of the thoracic belt. These fins are longer and slenderer than the ventrals, their tips almost reaching the origin of the latter fins. Their anterior ray is simple; the central rays are but once bifurcated, and only towards the last third of their length.

The scales are of moderate development, higher than long, subelliptical in shape, sometimes very irregularly so. Ten or eleven longitudinal rows on the line of the greatest depth, and six or seven rows on the peduncle of the tail. The lateral line is not to be seen.

Olivaceous brown; a silver band along the middle of the flanks, extending from the upper angle of the opercular apparatus to the base of the caudal fin. The cheeks, the opercles, and branchiostegal apparatus are silvery. A blackish stripe along the upper edge of the silvery band of the sides. The dorsal region is minutely dotted with blackish, the dots being more particularly crowded upon the outline of the scales. These dots extend to the upper surface of the head, and sparingly to the upper region of the thoracic and abdominal regions; also to the inferior half of the peduncle of the tail. The dorsal, caudal, and anal fins are almost greyish through the accumulation of the above-mentioned dots. The ventrals are unicolor; the pectorals greyish upon their external margin. The abdominal region sometimes exhibits an argentine reflection.

Inhabits the lagoons in the vicinity of Santiago, Chile.

### 35. *Cheirodon annæ* McAtee. (Plate XI, fig. 1.)

*Cheirodon annæ* McAtee, Proc. Acad. Nat. Sci. Phila., 1903, p. 515 (South America);

Eigenmann, Reports Princeton Univ. Patagonia, Vol. III, 1910, p. 429.

**Habitat:** Some unknown locality in South America.

The specimens of this species were received as an exchange from the U. S. National Museum. Their origin is in doubt. It is possible that they are the types of *C. pisciculus*.

4301, I. U. M. 927a-b, C. M. **Type and paratypes**, fifteen. Length of type, 43 mm. South America.

The specimens are soft and have lost their scales. The characters are otherwise well-preserved. If these specimens came from Chile, there is no doubt that they represent *C. pisciculus*, with which they agree in their extremely short anal and their elongate form.

Head 4.2; depth 3.6-4.2; D. 9-12; A. 12-15; scales 32-36, eleven scales between ventrals and dorsal, seven to nine scales with pores; eye 2.8-3.2; depth of caudal peduncle about 2 in its length.

Elongate, little compressed; predorsal and preventral areas rounded, with about (?) fifteen scales; occipital process short, reaching one-eighth to the dorsal;

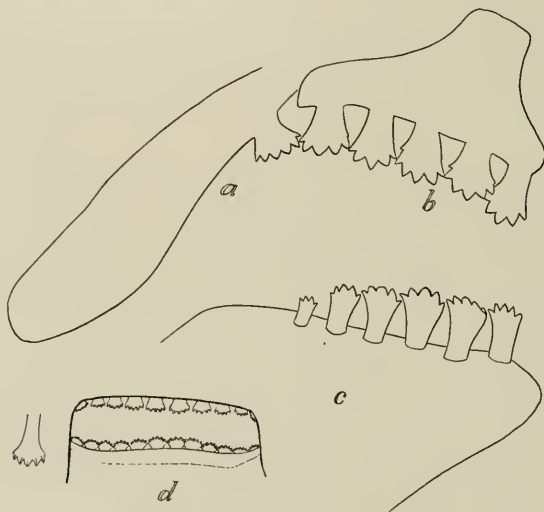
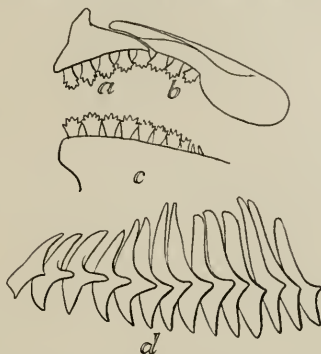
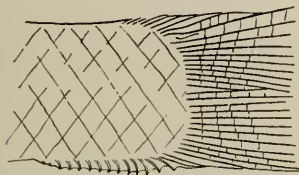


FIG. 21. *Cheirodon annae* McAtee, *a*, maxillary; *b*, premaxillary; *c*, portion of mandible; *d*, dentition seen from in front. 4307, C. M.

frontal fontanel half as long as the parietal; third suborbital very small, leaving a naked area, which is much the widest behind, about its entire distal margin; postorbitals minute, not covering more than one-fourth of the width of the cheek behind the eye; snout blunt, mouth small, maxillary a little over half as long as eye; teeth five- to seven-pointed, the middle point a little prominent, the bases of the teeth much contracted; four or five teeth in the premaxillary, one tooth (absent in two) on the maxillary, mandible with five or six graduated teeth. Gill-rakers 8 + 12, short, about one-third as long as eye.

Origin of dorsal a little nearer caudal than tip of snout, its height a little less than the length of head; adipose fin well-developed; caudal lobes about as long as head; base of anal about equal to snout and eye, considerably less than the length of the caudal peduncle; origin of anal below, or a little behind, the base of the last dorsal rays, first developed ray of the anal extending beyond the tip of the



**ERRATA**—FIG. 22. *Cheirodon* ~~insignis~~ <sup>insignis</sup> McAtee. Interhæmal spines of ♂.

FIG. 23. *Cheirodon* ~~insignis~~ <sup>insignis</sup> McAtee. a, premaxillary; b, maxillary; c, portion of mandible; d, portion of the interhæmals of ♂.

last ray; ventrals extending to, or a little short of, origin of anal, pectorals to, or a little short of, ventrals.

Thirteen interhæmals on the caudal peduncle of the female, extending four-tenths to base of last anal ray. The spines very strong, with broad lateral processes in the male, extending a little further toward the anal. Scales mostly removed. A distinctly silvery lateral band.

### 36. *Cheirodon insignis* Steindachner. (Plate XVII, fig. 2.)

*Cheirodon insignis* Steindachner, Fisch-Fauna Cauca & Flüsse bei Guayaquil, 1880, p. 22, pl. VI, fig. 3 (Cauca); Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429; Evermann & Goldsborough, Proc. Biol. Soc. Washington, Vol. XXII, p. 98 (Tabernilla, Atlantic slope of Panama Canal Zone).

*Cheirodon gorgonæ* Evermann & Goldsborough, l. c. p. 99. Below the dam at Gorgona, Canal Zone.<sup>32</sup>

<sup>32</sup> This species is said to differ from *insignis* "in the larger eye, the fewer anal rays and the slightly shorter dorsal rays" as well as in the teeth. The differences found may be tabulated as shown at foot of p. 70:

Meck & Hildebrand reporting on the wealth of material collected by them in Panama (Field Mus. Publ. Zool. Ser., vol. X, 1916, pp. 273–276), find that the specimens reported as *Cheirodon insignis* by Evermann and Goldsborough are representatives of a new genus and species, *Pseudocheirodon affinis*, Meck & Hildebrand, and that *Cheirodon gorgonæ* Evermann & Goldsborough, placed in the synonymy of *Cheirodon insignis*, is a member of the genus *Compura*.

**Range:** Magdalena and Atrato basin, Atlantic slope of Panama.

5367, C. M., 13042, I. U. M., many, largest about 25 mm. Truando. Wilson.

726, University of Michigan Museum, two, largest about 28 mm. Marsh at Fundación, Colombia.

Head 4; depth 2.5–3; D. 10 or 11; A. 17–20; scales 28–32, of which about six have pores; eye 3 in head, about equal to interorbital.

Compressed, breast slightly flattened, with a median series of nine or ten scales; predorsal area with about nine scales; occipital process short, reaching about one-sixth to the dorsal; frontal fontanel an equilateral triangle less than one-half as long as the parietal fontanel without the groove; maxillary reaching to below anterior margin of eye; third suborbital covering the entire cheek; premaxillary with five teeth; maxillary with two or three teeth.

Dorsal falcate, sometimes reaching to adipose, its origin in middle of body; anal emarginate, its lobe in the male reaching tip of last ray, not quite tip of last ray in female; ventrals reaching beyond origin of anal in male, the pectorals to the middle third of the ventrals; both fins shorter in the female.

Scales regularly imbricate, largest just above pectorals and ventrals; caudal naked; anal with a single series of scales along its base; ten scales between dorsal and ventrals.

Interhemals extending from near base or tip of last anal ray to caudal, eight to twenty-three in number, those of the males antrorse and with lateral wings, those of the female slender, their tips not exposed, pointing downward and backward.

A conspicuous caudal spot, surrounded by an unpigmented area; back and sides nearly uniformly punctate; margin of anal and dorsal dark.

### 37. *Cheirodon parahybæ* sp. nov. (Plate XI, fig. 2.)

6841a, C. M., **type**, 38 mm. 6841b–f, C. M., **paratypes**, six, largest 39 mm.

Campos, June 14, 1908. Haseman.

Head 3.75–4; depth 2.5–2.7; D. usually 11, rarely 10; A. 19–24; scales 34–36, eight or nine with pores; eye 2.5 in the head.

Compressed, preventral area and predorsal areas rounded, the somewhat

|                                 | <i>C. insignis</i> | <i>C. gorgonæ</i> |
|---------------------------------|--------------------|-------------------|
| Head.....                       | 3.6–3.8            | 3.5–3.8           |
| Depth.....                      | 2.8–3              | 3–3.2             |
| Eye in the head.....            | 2.5–2.6            | 2.2–2.45          |
| Longest dorsal ray in head..... | .8                 | 1                 |
| Anal.....                       | 21–22              | 17–19             |
| Longest anal ray in head.....   | 1.4–1.8            | 1.4–1.6           |

irregular median series consisting of about eleven scales; occipital process short, extending one-seventh to dorsal, bordered by three scales on each side; frontal fontanel half as long as the parietal; second suborbital in contact with the preopercle below, a broad naked area along its entire posterior margin; postorbitals feeble, not covering more than half the width of the postorbital area; maxillary little, if any, more than half as long as eye, slender, its margin not curved; teeth small, slender, contracted at the base, with five points, the middle one being largest; four teeth in the premaxillary, two in the maxillary, seven or eight graduated teeth on the mandible. Gill-rakers about  $7 + 10$ , very short, not quite one-fourth as long as eye.

Origin of dorsal a little nearer tip of snout than base of middle caudal rays or the reverse. Dorsal pointed, its height equal to the length of the head, or a little longer; adipose fin well-developed; caudal lobes much longer than head; origin of anal below the posterior part of the dorsal or behind the vertical from the last ray; fifteen to twenty interhæmal spines, extending from near base of last anal ray to caudal, with broad wings in the male; ventrals about reaching anal, pectorals a little beyond origin of ventrals. Scales thin, regularly imbricate, with few radial striæ; caudal naked, anal with a few scales on the bases of the anterior rays.

A large spot extending across the entire caudal peduncle, not extending on the middle caudal rays.

This species is very similar to *C. piaba* and *C. interruptus*, differing in the size of the naked area of the cheek, the number of interhæmal spines, the length of the maxillary, and the number of maxillary teeth.

### 38. *Cheirodon interruptus* (Jenyns). (Plate XII, fig. 1.)

*Tetragonopterus interruptus* Jenyns, Voy. Beagle: Fishes, 1842, p. 127, tab. 23, fig. 4 (Maldonado).

*Chirodon interruptus* Günther, Cat. Fishes Brit. Mus., Vol. V, 1864, p. 332; Perugia, Ann. Mus. Civ. Storia Nat. Genova, (2), Vol. X, p. 45, 1891 (Rio Plata).

*Cheirodon interruptus* Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; ? Boulenger, Boll. Mus. Univ. Torino, Vol. XII, 1897 (Tala); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Cheirodon monodon* Cope, Proc. Am. Philos. Soc., Vol. XXXIII, 1894, p. 91 (Rio Grande do Sul); Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 332 (Rio Grande do Sul); Eigenmann & Ogle, Proc. U. S. Nat. Mus., Vol. XXXIII, p. 9 (Rio Grande do Sul).



Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.  
 Range: Maldonado to Rio Grande do Sul.

The types of *interruptus* came from Maldonado and the specimens collected by Carey at the same place (No. 20698, M. C. Z.) are more than probably *interruptus*. These specimens are specifically distinct from the Paraguayan specimens, heretofore referred to *C. interruptus*. A careful comparison with the excellent fresh specimens from the Paraguay river and others from various places in the San Francisco basin, collected by Haseman, shows that they are so similar, that the Paraguayan form hitherto referred to *interruptus* must be referred to *C. piaba*.

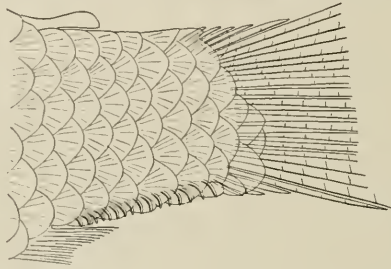


FIG. 24. Interhæmals in *Cheirodon interruptus* Jenyns. 6818, C. M.

Specimens from Rio Grande do Sul, the type locality of *C. monodon*, are very similar to *C. interruptus*, and *monodon* may be considered a variety of *interruptus*.

6815a-k, C. M., two males, eleven females, largest 45 mm. Rio Guahyba, Porto Alegre, Rio Grande do Sul. Jan. 21, 1909. Haseman.

6817a-d, C. M., fourteen, largest 40 mm. Santa Maria, Rio Vaceacahy-Mirim, secondary tributary of the Rio Jacuhy, Rio Grande do Sul. Haseman.

6818a-x, C. M., three males, largest 43 mm., twenty-six females, largest 49 mm.

Cachoeira, Rio Jacuhy, Rio Grande do Sul. Jan. 26, 1909. Haseman.

6852a, C. M., one female, 47 mm. Caecquy. Haseman.

846 & 847, M. C. Z., twelve, poor, largest a male about 35 mm. long. Uruguay river. Wyman.

20698, M. C. Z., forty, largest about 60 mm. and 20699, M. C. Z., one, 46 mm. Maldonado. T. G. Carey.

6816a-j, C. M., one male, 42 mm., nine females, largest 52 mm. Caecquy, Rio Ibicuhy, into Rio Uruguay. Jan. 31 & Feb. 1, 1909. Haseman.

This species can readily be distinguished by the naked area behind the third suborbital and by the numerous interhæmals. They extend from the anal to the

caudal and number seventeen to twenty-seven, all or only half of which may protrude in the male. The maxillary has but one tooth.

Head 4.5–4.66; depth 2.4–3; D. 11, very rarely 12; A. 17–24; scales  $\frac{32}{3}$ ,  $\frac{33}{3}$ ,  $\frac{34}{3}$ ,  $\frac{35}{7}$ ,  $\frac{36}{2}$ , in those examined; seven to twelve scales with pores; eye 2.5–3, about equal to interorbital; depth of caudal peduncle 1–1.5 in its length.

Compressed, dorsal and ventral profiles equally arched; preventral area flattened, with a median series of about thirteen scales; predorsal area rounded, with thirteen scales; frontal fontanel from half to one-third as long as the parietal; a broad naked area behind the third suborbital, sometimes extending forward a little at the angle of the preopercle, postorbital not half as wide as the naked area behind it; mouth small, maxillary little, if any, longer than half the eye, shortest in specimens from Cacequy and Maldonado, in which its free margin is more convex. Premaxillary with four or five teeth (six in a few premaxillaries); maxillary uniformly with a single tooth (except in one maxillary, which in addition has a minute tooth); five, six, or seven graduate teeth in mandible, the teeth five- to seven-pointed, the base narrower than the tip. Gill-rakers 7 + 12, to 9 + 13, short, the longest not quite a third as long as the eye.

Origin of the dorsal equidistant from tip of snout and base of mid-caudal rays.



FIG. 25. *Cheirodon monodon* Cope. a and b, premaxillary and maxillary with their teeth.

Adipose fin well-developed. Origin of anal about equidistant from snout with last dorsal ray. Pectorals reaching ventrals, the ventrals not quite to the anal, the fourth or fifth to the eighth to fourteenth anal rays of the male with hooks; the ventrals in adult males also with hooks; seventeen or more interhaemals on caudal peduncle, those of male contiguous, with broad lateral processes, especially the anterior ones, their spines projecting from near base of last anal ray.

Scales thin, regularly imbricate, with few to many diverging radial striæ; caudal naked; anal with a few scales in a single series at base of anterior rays.

A silvery lateral stripe; chromatophores variously developed, some specimens from Cacequy are almost free from pigment, except a faint caudal spot; in others the pigment is well-developed, the specimens appearing quite dark, the caudal spot being well defined or more diffuse in outline, not extending upon mid-

caudal rays. The base of the anal in specimens from Porto Alegre, Cachoeira, and Maldonado is but little, if any, longer than the caudal peduncle. In all but one of the Cacequy specimens it is equal to the caudal peduncle and middle caudal rays, and usually contains twenty-two rays, more rarely twenty-one, twenty-three, or twenty-four.

There may be two, possibly three, varieties in the material at hand. If so, they may be distinguished by the following characters:

- a. Base of anal less than caudal peduncle and middle caudal rays.
  - b. A. 18-23, most frequently 19-20; most frequently 5-5 teeth in the premaxillaries, less frequently, 4-4 or 4-5 or 5-6; base of anal equal to the length of the caudal peduncle. Caudal spot usually well defined. Nos. 6815, 6817, 6818 (Rio Grande do Sul).....39. *monodon* Cope.
  - bb. A. 17-22, most frequently 19; usually 5-5 teeth in the premaxillary; base of anal equal to the length of the caudal peduncle or a little longer. Nos. 846, 847, 20698 and 20699, M. C. Z. (Uruguay river basin).....38. *interruptus* Jenyns.
- aa. A. 21-24, most frequently 22; 4-4, or 4-5 teeth in the premaxillary; base of anal equal to length of caudal peduncle and middle caudal rays. Caudal spot diffuse. No. 6816 (Cacequy).
  - 40. *ibicuihensis* Eigenmann *var. nov.*

TABLE SHOWING IN DETAIL THE NUMBER OF SPECIMENS WITH THE INDICATED NUMBER OF PREMAXILLARY TEETH AND OF ANAL RAYS.

|                          | Premaxillary Teeth. |      |      |      |      | Anal Rays. |     |     |     |     |     |     |     |
|--------------------------|---------------------|------|------|------|------|------------|-----|-----|-----|-----|-----|-----|-----|
|                          | 4-4.                | 4-5. | 5-5. | 5-6. | 6-6. | 17.        | 18. | 19. | 20. | 21. | 22. | 23. | 24. |
| No. 6818, C. M. ....     | 9                   | 4    | 13   | 1    |      |            | 2   | 10  | 3   | 2   |     |     |     |
| No. 6815, C. M. ....     |                     | 4    | 8    | 1    |      |            | 2   | 4   | 2   | 1   | 3   | 2   |     |
| No. 6817, C. M. ....     | 1                   | 1    | 1    |      |      | 1          |     |     | 2   | 1   |     |     |     |
| No. 20698, M. C. Z. .... | 1                   | 2    | 21   | 1    | 4    | 1          | 2   | 14  | 8   | 6   | 6   | 1   |     |
| No. 6816, C. M. ....     | 5                   | 4    |      |      |      |            |     |     |     | 2   | 7   | 1   | 1   |

41. *Cheirodon notomelas*, sp. nov. (Plate XII, fig. 2.)

6812, C. M., **type**, ♀, 35 mm.; 6813a-q, C. M., **paratypes**, nineteen, largest 40 mm. collected in a lake, four miles from Miguel Calmone, Tieté basin. Oct. 11, 1908. Haseman.

6814, C. M., one, 30 mm. Piperão Azul, lake twelve miles from Tieté. Oct. 7, 1908. Haseman.

Head 4; depth 2.5-2.66; D. 10 or 11; A. 20-22; scales usually 33 (32-34), six to eight with pores; eye about 2.5 in the head, equal to the interorbital; depth of caudal peduncle about equal to its length.

Compressed, dorsal and ventral profiles equally curved; preventral area rather flat with a regular median series of eleven scales; predorsal area narrowly rounded with a median series of ten or eleven scales; occipital process broad, reaching one-seventh to dorsal, bordered by two and one-half scales on each side; skull convex;

frontal fontanel an equilateral triangle, not more than one-third as long as the parietal; third suborbital less than half as wide as eye, in contact with the preopercle along the lower limb and the angle of the preopercle, a narrow naked area behind it, and a narrow naked strip behind the postorbitals. Mouth small, the maxillary half as long as eye. Teeth broad-tipped, seven-pointed, the median point prominent, especially in the premaxillary. Four teeth in the premaxillary, two in the maxillary, and seven or eight in the mandible. Gill-rakers 5 + 7, about one-fourth as long as the eye.

Origin of dorsal equidistant from tip of snout and base of caudal. Dorsal pointed, its height about equal to the length of the head; adipose fin well-developed, caudal lobes a little longer than head; origin of anal a little behind the vertical

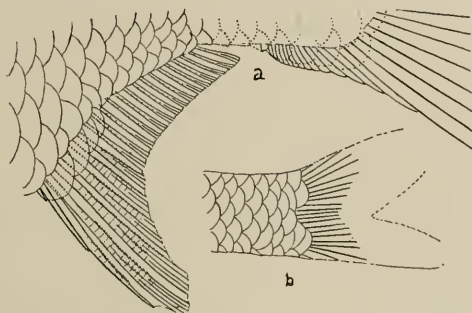


FIG. 26. *Cheirodon notomelas* Eigenmann. *a*, anal and interhæmials of a ♀, 6S13, C. M.; *b*, details of the arrangement of the scales at the base of the caudal in a ♂, 6S13a, C. M.

from the last dorsal ray; tip of highest ray reaching to the base of the last fourth of the base; pectorals reaching ventrals, ventrals not quite to anal.

Scales regularly imbricate, a few scales in a single series along base of anterior anal rays, ten scales between dorsal and ventral, caudal lobes naked.

First dorsal rays and bases of the rest black; a sub-rhomboidal black spot across the entire caudal peduncle, the spot bordered by unpigmented areas in front and behind, the spot not extending to the end of the middle rays; anal dusky, the first rays sometimes black. General color darker than usual in the genus.

Base of the anterior half of the anal of the male as usual for this genus, much more oblique than the base of the rest of the fin; fourth to ninth anal rays of the male much thicker than the rest, with many retrorse hooks along the posterior edges of the middle part of the rays.



42. *Cheirodon madeiræ*, sp. nov. (Plate XIII, fig. 1.)

6847, C. M., one, 34 mm. San Joaquín, Bolivia. Sept. 4, 1909. Haseman. A small-mouthed species, without color-markings.

Head 4; depth 3; D. 11; A. 23; scales  $10 + 24$ ; ten scales between dorsal and ventrals; eye 2.4 in the head; depth of caudal peduncle nearly equal to its length.

Moderately compressed; preventral area rounded, with a median series of twelve scales; predorsal area rounded, with a median series of eleven scales; occipital process extending about one-seventh to the dorsal; skull convex; frontal fontanel a little longer than broad, less than half the length of the parietal; mouth minute, maxillary about half the length of the eye; premaxillary with five teeth, maxillary with two; mandible with broad, seven-pointed teeth, the median point being a little the longer; cheeks covered by the third suborbital, leaving a narrow naked wedge behind; postorbitals nearly covering the entire postorbital area. Gill-rakers  $7 + 11$ .

Origin of dorsal equidistant from tip of snout and base of caudal; origin of anal under posterior part of dorsal. Caudal peduncle with about nine weak interhæmals; ventrals not reaching anal; the pectorals reaching beyond origin of ventrals. Scales as in other species of the genus. No color-markings.

43. *Cheirodon piaba* Lütken. (Plate XIII, fig. 2; Plate XVII, figs. 5-6.)

*Cheirodon piaba* Lütken, Oevers. Dan. Selsk. No. 3, 1874, p. 134 (Rio das Velhas); Velhas-Flodens Fiske, 1875, p. xiv and p. 219, fig. on p. 221 (Rio das Velhas); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 291; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Tetragonopterus bellottii* Ulrey (*non* Steindachner): in part, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 286 (Santarem).

*Cheirodon insignis* Ulrey (*non* Steindachner): in part, *l. c.* 291 (Brazil); Eigenmann & Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 515 (Arroyo Trementina & Arroyo Pypucu).

*Cheirodon calliurus* Boulenger, Boll. Mus. Torino, Vol. XV, 1900, p. 370 (Caranda-sinbo near Corumbá. San Lorenzo, Prov. Jujuy, Argentina); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Cheirodon interruptus* Eigenmann & Kennedy (*non* Jenyns), Proc. Acad. Nat. Sci. Phila., 1903, p. 514 (Campo Grande; brook near Arroyo Trementina); Ann. Carnegie Mus., Vol. IV, 1907, p. 126 (Puerto Max); Eigenmann & Ogle, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9.



*Cheirodon micropterus* Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9 (Santarem); Reports Princeton Univ. Exped. Patagonia, Vol. III, p. 429.

**Range:** Abundant in Rio Paranahyba, Rio San Francisco, upper Paraná, and Paraguay; rare south of these points, and in Amazons.

The very large number of specimens recorded below, most of them in excellent condition, together with the specimens recorded by me in the papers quoted above, enables me to revise the synonymy and bibliography of this species. As stated by Eigenmann & Ogle a comparison of one of the types of *calliurus* with specimens recorded by me as *interruptus* showed that these specimens belong to the same species. At the same time the opinion was expressed that these specimens were probably distinct from *interruptus*. The material at hand shows that the Paraguayan specimens are specifically identical with *C. piaba*, originally recorded from the Rio das Velhas and found abundantly throughout the Rio San Francisco.

The type of *micropterus* is poor, but is very probably also a *C. piaba*.

Aside from the specimens previously recorded, some of which are again enumerated, I have examined many specimens collected by Mr. J. D. Haseman.

6821a-b, C. M., two males, largest 33 mm. Aregua, Paraguay. April 8, 1909. Haseman.

6822a-g, C. M., seven, two males, 33 and 39 mm., two females, 36 and 39 mm. three females, the largest 30 mm.<sup>33</sup> Corumbá, Paraguay. April 27, 1909. Haseman.

6824a-p, C. M., seven males, largest 38 mm.; nine females, largest 38 mm. Puerto Suarez. May 6, 1909. Haseman.

9984, I. U. M. 933a-b, C. M., ten, largest 42 mm. to base of caudal. Campo Grande. Anisits.

9997 and 10122, I. U. M.; 926a-b, C. M., sixteen, largest 31 mm. to base of caudal. Arroyo Pypucu. Anisits.

6825a-h, C. M., nine, largest 35 mm. Asunción, Paraguay. March 28, 1909. Haseman.

10289, I. U. M., Colonia Gonzales. Anisits.

6826a-b, C. M., two, 21<sup>34</sup> and 44 mm. Caceres. May 27, 1909. Haseman.

9985, I. U. M. 953a-b, C. M., thirteen, largest 40 mm. to base of caudal. Arroyo Trementina. Anisits.

6908a-f, C. M., six, 15<sup>35</sup>-20 mm. Caceres. May 24, 1909. Haseman.

<sup>33</sup> In these smaller specimens and in the two males, the caudal spot extends further on the caudal than in the two larger females.

<sup>34</sup> The smaller has only one tooth on the maxillary.

<sup>35</sup> In the smallest the color is most profuse and the caudal spot extends to near tip of the middle rays.

- 6823a-u, C. M., twenty-one, largest 39 mm. Lagoa de Parnagua. Jan. 17, 1908. Haseman.
- 6827a-k, C. M., one male, twelve females, largest 43 mm. Rio das Velhas, tributary of Rio San Francisco. May 13, 1908. Haseman.
- 6828a-x, C. M., twenty-one males, largest 38 mm.; thirty-two females, largest 38 mm. Pirapora, Rio San Francisco. Dec. 15, 1907. Haseman.
- 6829a-b, C. M., two. Lagoa Pereira, San Francisco basin. Dec. 23, 1907. Haseman.
- 6830a-b, C. M., two. Lagoa de Porto, San Francisco basin. Dec. 24, 1907. Haseman.
- 6831a-x, C. M., seven males,<sup>36</sup> largest 37 mm., twenty-seven females, largest 39 mm. Barreiras, Rio San Francisco. Jan. 4, 1908. Haseman.
- 6832a-g, C. M., seven, largest 31 mm. Boqueirão, near mouth of Rio Preto, San Francisco basin. Jan. 6, 1908. Haseman.
- 6833a-x, C. M., twenty-eight, largest 38 mm. Santa Rita, San Francisco basin. Jan. 26, 1908. Haseman.
- 6834a-e, C. M., five,<sup>37</sup> largest 39 mm. Penedo at mouth of Rio San Francisco. March 22, 1908. Haseman.
- 6835a-c, C. M., three. Rio Coite, San Francisco basin. Nov. 6, 1907. Haseman.
- 6846a, C. M., one, 40 mm. Lagoa Salgado, San Francisco basin. Nov. 10, 1907. Haseman.
- 6838a-d, C. M., four, largest 35 mm. Rio Itapicurú, Fazenda de Amaratu, 6 miles north of Bom Fin. Nov. 21, 1907. Haseman.
- 6836a-f, C. M., six, largest 33 mm. Rio de Jacobina, tributary of Rio Itapicurú. A. 19-21. Haseman.
- 6837a-b, C. M., two, largest 39 mm. Queimadas, Rio Itapicurú. March 2, 1908. Haseman.
- 6839a-h, C. M., eight, 39 mm. Alagoinhas, Rio Catu. March 4, 1908. Haseman.
- 6840a, C. M., one, 35 mm. Cachoeira, Rio Paraguassú. April 14, 1908. Haseman.
- 6842a-x, C. M., twenty-five, largest 42 mm. Bebedouro, near Rio Grande and Rio Paraná. Sept. 1, 1908. Haseman.
- 6844a, C. M., one male, 25 mm. Santa Maria, Rio Vaccacahy-Mirim, tributary of the Jacuhy, Rio Grande do Sul. Jan. 29, 1909. Haseman.

<sup>36</sup> Color prominent, spot extending to end of middle rays in some. Depth 2.33-2.8.

<sup>37</sup> With ripe eggs.

6843a-x, C. M., thirty-five, largest 38 mm. Jaquara, Rio Grande, into Rio Paraná. Aug. 18 and 19, 1908. Haseman.

6845a-e, C. M., five, largest 41 mm. Cacequy, secondary tributary of the Rio Uruguay. Jan. 31, 1909. Haseman.

Head 3.6-4.5; depth 2.25-3; D. 11; A. 19-27 most frequently 22 or 23; scales 31-36, most frequently 33 or 34, 9-12 with spines; eye equal to interorbital, about 2.5 in the head; depth of caudal peduncle 1.25 in its length; base of anal much longer than caudal peduncle.

Compressed, depth very variable, the dorsal and ventral profiles symmetric, nearly equally arched; preventral area flat, with well-marked lateral edges, eleven to thirteen scales in a median series; predorsal area keeled, with ten scales in a median series, which is regular to near the occipital process; occipital process short, extending one-sixth to one-seventh to the dorsal, bordered by two or three scales;



FIG. 27. *Cheirodon piaba* Lütken. a, premaxillary; b, maxillary.

frontal fontanel an equilateral triangle, 2.5-3.5 in the length of the parietal fontanel; interorbital convex; third suborbital covering the entire cheek, or a very narrow naked wedge behind it; lower one of the postorbitals as wide as the third suborbital at its tip, sometimes covering the entire width to the preopercle; the upper postorbital much narrower, leaving a wider naked strip; mouth minute, maxillary not, or barely, reaching the eye, nearly vertical, very little more than half the length of the eye; maxillary with one tooth in three specimens, two teeth in sixty-two specimens, and three teeth in seven specimens examined; premaxillary with five teeth; mandible with about seven teeth; teeth sometimes black-tipped. Gill-rakers about 6 + 11, not over one-fourth as long as eye.

Origin of dorsal equidistant from tip of snout and base of caudal, the highest ray a little over length of head; origin of anal a little behind vertical from base of last dorsal ray; pectorals reaching to, or beyond, origin of ventrals, ventrals not to anal; eight to thirteen rays of the anal (beginning with the second or third) of the male with hooks, base of the hook-bearing portion of the anal, making an angle with the base of the rest of the fin; all but the outer two ventral rays with similar hooks;

base of anal about equal to length of caudal peduncle plus the middle caudal rays; the interhæmals, nine to thirteen in number, occupy four-tenths to six-tenths of the distance between the base of the last anal ray and the caudal, beginning a little behind the tip of the last anal ray. Those of the male without lateral processes, sometimes with a low ridge or keel running along the sides of the anterior ones and ending in a knob in front of them; lower caudal fulera prominent, continuous with the interhæmals. Scales normal.

There is a caudal spot of varying size and intensity, sometimes extending

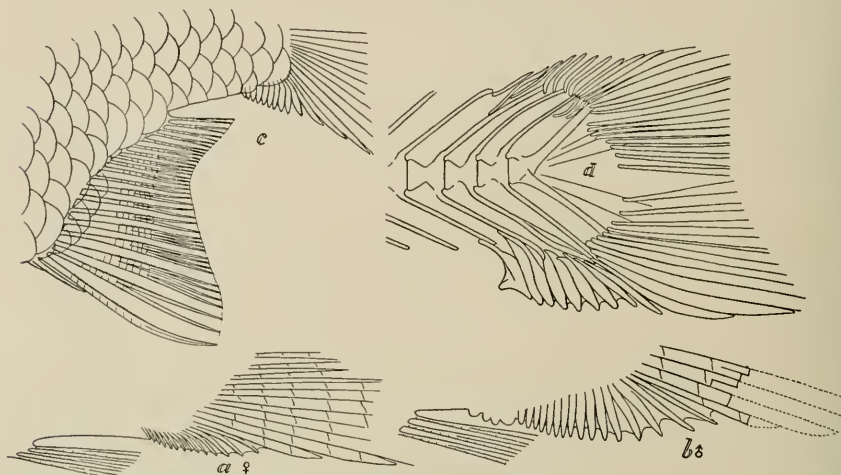


FIG. 28. *Cheirodon piaba* Lütken. *a*, region between anal and caudal in ♀; *b*, Do. in ♂. Lagoa Paranaqua, 6823, C. M.; *c*, anal fin and caudal fulera and interhæmals of ♂, 6828, C. M.; *d*, skeleton of fulera and interhæmals of ♂, 6843, C. M. (All figures greatly enlarged.)

entirely across the end of the caudal peduncle, sometimes extending on the middle caudal rays, rarely to their tips; a faint black line overlaid with silvery along the middle of the sides; anterior margin of dorsal dark; general color very pale or quite dark, depending on the nature of the locality from which the specimens came.

It is possible that we should refer to this species a small specimen, 6909, C. M., 15 mm. long, taken in a tributary of the Guaporé about forty miles south of Villa de Matto Grosso.

#### 44. *Cheirodon microdon* sp. nov. (Plate XIV, fig. 1.)

This species is allied to *Cheirodon stenodon* and to *Aphyocheirodon hemigrammus*. ERRATA  
6850, C. M. **Type**, 42 mm. 6851a-b, C. M., **paratypes** two, the larger 41 mm.,  
Caceres, Upper Paraguay, May 24, 1909. Haseman.



Head 4-5; depth 3; D. 11; A. 23-25; scales in a median line are 34-36, of which 10-11 are with pores; ten and one-half scales between dorsal and ventrals. Eye 2.75 in head, very little greater than interorbital.

Compressed, slender; dorsal and ventral profiles nearly equally curved; pre-ventral area flat, with rather well-defined lateral angles, and with a nearly regular median series of twelve scales; predorsal area with a median series of eleven scales; occipital process extending one-sixth to one-seventh to the dorsal, bordered by three scales on each side; frontal fontanel triangular, the sides of the triangle but little longer than the base, about 2.5 in the length of the parietal fontanel; mouth large, maxillary three-fourths as long as eye; teeth five-pointed; the median points

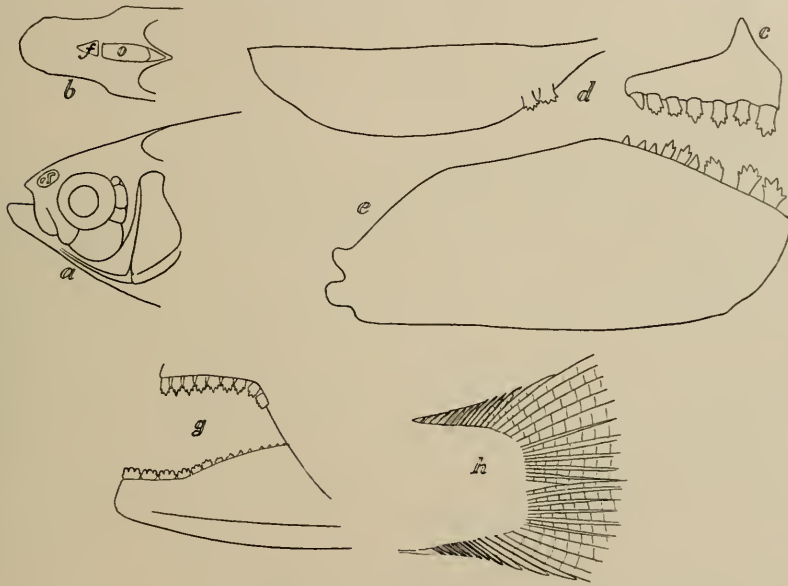


FIG. 29. *Cheirodon microdon* Eigenmann. a, outline of side of head; b, top of head, showing fontanels; c, premaxillary; d, maxillary; e, maxillary; g, dentition; h, details of interneurals and interhæmals, 6S50, C. M.

of the premaxillary projecting considerably beyond the lateral points, the three median points of the teeth of the lower jaw about equal, the extreme lateral points minute; seven to nine teeth in the premaxillary, two in the maxillary; teeth in front of the lower jaw rapidly graduated from the third to the sixth; sides of lower jaw upturned, with several (about six) minute, conical teeth; third suborbital leaving but a very narrow wedge-shaped naked area behind; postorbitals covering



half to two-thirds of the postorbital area. Gill-rakers  $7 + 13$ , the longest about one-third as long as eye.

Origin of the dorsal very little nearer tip of snout than to middle caudal rays, the highest ray a little greater than the head; adipose fin well developed; origin of anal below the posterior part of dorsal. Ventrals not reaching anal, the pectorals about to the origin of the ventrals.

Scales thin, regularly imbricate, with few diverging radial striae. Caudal naked; anal with a few scales in a single series along base of anterior rays.

Interhæmal spines of the caudal peduncle feeble, about eight to ten in number.

A faint caudal spot, not directly continued forward as a dark band; upper part of the anterior dorsal rays dark. A silvery lateral stripe.

The three specimens here described appear to be females. They are probably from an area in which the color-cells do not reach their fullest pigmentation. The species distinctly differs from *C. stenodon* in the character of the teeth.

45. *Cheirodon stenodon*, sp. nov. (Plate XIV, fig. 2.)

6848a, C. M., type, 33 mm., 6849a-x, C. M., paratypes, over thirty, largest 34 mm. Bebedouro, near Rio Grande and Rio Paraná. Sept. 1-5, 1908. Haseman.

A long-jawed, small-toothed, slender species, with feeble interhæmals.

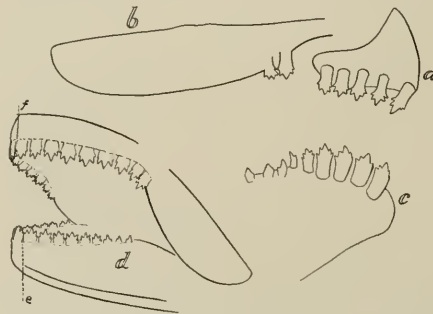


FIG. 30. *Cheirodon stenodon* Eigenmann. a, b, c, premaxillary, maxillary, and mandible; d, dentition; e-f, symphyseal line.

Head 4; depth a little more than 3; D. 10; A. usually 20 or 21, rarely 18, 19, or 22; scales in a median series 36 or 37, rarely 32; six to eleven scales with pores; eight to ten scales between dorsal and ventrals; eye 2.75 in head, equal to the inter-orbital; depth of caudal peduncle about 1.33 in its length.

Compressed, slender; dorsal and ventral profiles nearly equally curved; pre-ventral area rounded, with a nearly regular median series of twelve to thirteen scales; predorsal area rounded, with a perfect median series of nine to ten scales; occipital process extending one-sixth to one-seventh the distance to the dorsal, bordered by three scales on each side; frontal fontanel equilateral, less than half as long as the parietal; skull convex, smooth between the eyes.

Maxillary comparatively long, at least two-thirds as long as eye, its free margin a little convex; teeth narrow, the sides nearly parallel; a large median point and two small points on each side, those of the front of the lower jaw slightly broader than those of upper jaw; premaxillary teeth five to seven; maxillary teeth two; mandibular teeth six to nine, the first four of nearly equal size, those on sides rapidly graduated, the last ones conical; third suborbital covering the cheek below, leaving only a narrow naked wedge behind it. Postorbitals covering about two-thirds of the width of the postorbital area. Gill-rakers  $6 + 12$ .

Origin of the dorsal equidistant from snout and middle caudal rays, the dorsal pointed, its highest ray about equal to length of head. Adipose fin well-developed. Origin of anal under the vertical from posterior part of the dorsal. The interhæmals of the caudal peduncle weak, very few, about five, if at all developed, not projecting in any of these specimens. Ventral not reaching anal. Pectorals long, reaching to or nearly to the ventrals. None of the anal rays have hooks; it is probable therefore that the specimens are all females.

Scales regularly imbricate, with a few diverging radial striæ; caudal naked. Anal with a few scales along the base of the anterior rays.

Straw-colored, the scales of the back margined with a row of chromatophores; a large triangular caudal spot not extending to the end of the middle rays, continued forward along the middle of the sides as a narrow band to in front of dorsal. Tip of dorsal and membranes between first and second and upper half of second and third dark.

#### Genus XX. *HOLESTHES*<sup>38</sup> Eigenmann.

*Holoshesthes* Eigenmann, Smiths. Misc. Coll. Quarterly, Vol. XLV, 1903, p. 144.

**Type:** *Cheirodon pequirá* Steindachner.

Very similar to *Aphyocheirodon* and *Odontostilbe*.

Teeth notched, in a single series, six or seven in the premaxillary, rather narrow, but little expanded toward tip, more or less ovate, with five to seven notches, of which the median one is a little the larger, the rest being lateral; mandib-

<sup>38</sup> ὁλος = complete; ἱσθῆς, ἦ = clothing, in allusion to the complete dentition of the maxillary. I here take opportunity to amend the spelling of this generic name.

ulary teeth much expanded at the tip, with a small basal notch on each side and *three median points* of about the same size and extent. Maxillary with few teeth, broad-tipped, the points nearly alike. Mouth moderate; third suborbital in contact with the preopercle below; frontal fontanel short; adipose fin well-developed; origin of anal below end of dorsal; caudal naked; lateral line complete; scales with very few radial striæ; interhæmals of the caudal peduncle not projecting.

Minute fishes of southern and eastern Brazil and Paraguay.

#### KEY TO THE SPECIES OF *HOLESTHES*.

- a*. Dorsal with a large, oblique, black wedge extending from the upper part of the anterior ray toward the middle of the sixth ray; male with the outer ventral and first developed dorsal ray filiform. 46. *pequira* (Steindachner).  
*aa*. Tip of dorsal faintly dusky; interhæmals of the caudal peduncle of the male much stronger than the inter-neurals; outer ventral ray and first dorsal rays not filiform.....47. *heterodon* Eigenmann.

#### 46. *Holesthes pequira* (Steindachner). (Plate XV, fig. 1.)

? *Salmo pequira* Natterer, MS.

*Cheirodon pequira* Steindachner, Anz. Ak. Wiss. Wien, 1882, p. 180 (Rio Guaporé); Flussf. Süd-am., Vol. IV, 1882, p. 38 (Cujabá); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. IV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Boulenger, Boll. Mus. Univ. Torino, Vol. XII, 1897 (Caiza; Mission de San Francisco).

*Holoshesthes pequira* Eigenmann, Smiths. Misc. Coll. Quarterly, Vol. XLV, 1903, p. 144; Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429.

*Odontostilbe trementinae* Eigenmann and Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 513 (Arroyo Trementina); Eigenmann, Ann. Carnegie Mus., Vol. IV, 1907, p. 125 (Puerto Max); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

**Range:** Upper Madeira, Paraguay.

In the original description of *pequira* Steindachner states that the entire



FIG. 31. *Holesthes pequira* (Natterer). *a*, maxillary; *b*, premaxillary.

anterior edge of the maxillary is finely dentate and that the caudal spot is very small. If Steindachner's statement is correct then *trementinae* is a valid species

and the type of a distinct genus. But the statement was probably made without microscopic preparations. Furthermore the specimens had been in alcohol for fifty-eight years when the description was prepared and it is possible that they were faded and the caudal spot small in consequence. Except for these two characters the description of *pequira* applies very well to specimens of *trementina* and indeed in two of the specimens enumerated below the caudal spot is quite small. There is no other species known from the upper Paraguay related to these, which has an oblique bar on the upper part of the dorsal.

Specimens sent me from the British Museum as *pequira* are *Odontostilbe microcephala*.

7317a, C. M.; 9987, I. U. M., nine, **type and paratypes** of *trementina*. Arroyo Trementina. Anisits.

9986 and 9987, I. U. M. Brook near Arroyo Trementina.

6857a-l, C. M., twelve, largest 43 mm. Villa Hays, Paraguay. April 13, 1909. Haseman.

10187, I. U. M., one, Puerto Max. Anisits.

6858a-e, C. M., five,<sup>39</sup> largest 31 mm. Asunción, Paraguay. March 28, 1909. Haseman.

6859a, C. M., one, 35 mm. Caceres, Paraguay. May 27, 1909. Haseman.

6860a-b, C. M., two, largest 43 mm. Corumbá, Paraguay. April 27, 1909. Haseman.

6861a-h, C. M., eight, largest 45 mm. Sapucay, Paraguay. April 2, 1909. Haseman.

6862a-e, C. M., five, largest 56 mm. Cacequy, Rio Ibicuhy. Feb. 1, 1909. Haseman.

6877a-c, C. M., three, largest 55 mm. Santa Maria, Rio Maccacahy Mirim. Jan. 29, 1909. Haseman.

Head 4.5; depth 3-3.5; D. 11; A.  $\frac{2.1}{2}$ ,  $\frac{2.2}{3}$ ,  $\frac{2.3}{2}$ ,  $\frac{2.4}{3}$ ,  $\frac{2.5}{1}$ ; scales 6- $\frac{3.5}{2}$ ,  $\frac{3.6}{1}$ ,  $\frac{3.7}{4}$ ,  $\frac{3.8}{2}$ ,  $\frac{3.9}{1}$ —4; eye 2.75-3 in the head, equal to, or a little greater than, interorbital; depth of caudal peduncle about 3 in the depth, 1.5 in its own length.

Compressed, elongate; the dorsal and ventral profiles equally arched; the pre-ventral area flat, with a nearly regular median series of thirteen scales; predorsal area rounded or bluntly keeled, with about ten scales; occipital process one-sixth in the distance from its base to the dorsal, bordered by two or three scales; frontal fontanel a little longer than wide, triangular, its length a little more than two in the parietal fontanel; mouth small, the maxillary scarcely reaching to below the

<sup>39</sup> Caudal spot minute in two.

anterior margin of the eye. Teeth of the upper jaw narrow, with a large median point and three small points on the side of the tooth; teeth of lower jaw much wider, broad-tipped, with five points, three of these of equal size and prominence, the lateral points minute and much below level of the other three; maxillary usually with two or three teeth, rarely four; premaxillary teeth six and six or six and seven; mandible with about six notched, graduated, teeth followed on the side with about three minute, conical teeth; second suborbital and lower postorbital leaving but a narrow, naked area between them and the vertical limb of the preopercle. Gill-rakers 7 + 12.

Origin of dorsal equidistant from tip of snout and some distance behind tip of adipose, its height little greater than length of head. The first ray in the male prolonged into a filament, which sometimes reaches the adipose fin. Anal emarginate, its origin below the base of the last dorsal ray, base equal to length of head and about one-fourth of pectoral; ventral usually not reaching anal, its outer ray sometimes (in some males) filiform, reaching beyond origin of anal; origin of ventrals in front of the vertical from the first dorsal ray; pectorals not quite reaching ventrals in female, a little beyond their base in some males; no prominent interhæmals in males or females; about seven (beginning with the first fully developed) rays of the anal of the male with hooks.

Scales thin, regularly imbricate, with few if any radial striæ; caudal naked; a small sheath at the base of the anterior anal rays; lateral line but little decurved.

Distinguished from the other members of the genus by the large dorsal spot, which is wedge-shaped from the upper part of the first fully developed dorsal ray (the second) to the middle of the sixth or seventh ray; sometimes a minute black spot near the middle of the first fully developed anal ray; caudal peduncle usually with a large, conspicuous spot, which extends a little way on the middle caudal rays and usually upward and downward across the entire caudal peduncle. The caudal spot more rarely (6858a-b) very small, circular. A well-defined silvery lateral band.

The specimens from the province of Rio Grande do Sul, Nos. 6862 and 6877, are larger than the rest. The caudal spot is restricted, ovate, but faintly extended upward and downward. They are slenderer, depth 2.33-2.66; with the six interhæmals and nine interneurals of the caudal peduncle of the male equally well-developed.

As there is still a little doubt about their identity, I add the original description of *pequira* as given by Steindachner, *l. c.*:

(P. 38) "Seitenlinie vollständig; Körperform sehr gestreckt. Bauchlinie bis



zur Ventrals bald mehr, bald minder bedeutend gebogen und in der Regel ein wenig schwächer zur Bauchflosse abfallend, als die nur sehr wenig gebogene Rückenlinie zur Dorsale ansteigt. Dorsale in der Mitte der Körperlänge, hinter der Basis der Ventralen (in verticaler Richtung) beginnend. Silberfarbige Seitenbinde unterhalb der Dorsale bis zur Caudale scharf ausgeprägt, weiter nach vorn an den Rändern verschwommen. Caudalfleck *sehr klein*, doch deutlich sichtbar. Humeralfleck in der Regel fehlend, oder nur äusserst schwach angedeutet. Eine durch starke Anhäufung dunkler Punkte gebildete schräge Binde in der oberen Hälfte der Dorsale.

“Stirn querüber gewölbt. Mundspalte sehr klein. Oberkiefer am ganzen vorderen Rande *sehr fein gezähnt*.”

“Leibeshöhe  $3\frac{1}{4}$ mal, Kopflänge  $3\frac{3}{4}$ mal in der Körperlänge; Augendiameter  $2\frac{2}{3}$ – $2\frac{3}{4}$ mal, Stirnbreite nahezu 3mal, Schnauzenlänge fast 4mal in der Kopflänge enthalten.

(P. 39) “Die Höhe der Dorsale erreicht eine Kopflänge; die stark zugespitzten Caudallappen sind merklich länger als der Kopf. Die Spitze der Ventrals reicht genau bis zum Beginn der Anale, die der Pectoralen nahezu bis zur Basis der Ventralen. Rumpf hell goldgelb, gegen die Bauchseite herab hellgelb.

“D. 11. A. 22. L. lat. 35–36 (bis zur Basis d. Caudal.). L. tr.  $6\frac{1}{4}$ .”

“Zahlreiche Exemplare bis zu 38 mm. Länge, von J. Natterer im Jahre 1824 (Send. VIII, Nr. 59) im Cuyaba gesammelt, und *Salmo pequirã* genannt.”

#### 47. *Holesthes heterodon* sp. nov. (Plate XV, fig. 2.)

**Range:** Rio San Francisco to Rio Ribeiro.

6875a, C. M., **type**, female. 48 mm. Jaguara, Rio Grande emptying into Rio Paraná, August 18, 1908. Haseman.

**Paratypes** all of the following:

6876a–x, C. M., twenty-seven, largest 49 mm. Jaguara, Aug. 18, 1908. Haseman.

6864a–p, C. M., sixteen, largest 50 mm. Sete Lagoas, May 5, 1908. Haseman.

6865a–x, C. M., twenty-six, largest 50 mm. Bebedouro near Rio Grande and Rio Paraná, Sept. 1, 1908. Haseman.

6866a–h, C. M., eight, largest 38 mm. Pirapora, Dec. 5, 1908. Haseman.

6867a, C. M., one, 36 mm. Rio das Velhas, May 18, 1908. Haseman.

6868a–e, C. M., five, largest 38 mm. Lagoa Pereira, Dec. 23, 1907. Haseman.

6869a–c, C. M., three, largest about 41 mm. Rio Zinga, Nov. 7, 1907. Haseman.

6870a, C. M., one, 28 mm. Barreiras, Lagoa of Rio Grande, San Francisco basin, Jan. 3 or 4, 1908. Haseman.

6871a-o, C. M., fifteen, largest 46 mm. São João del Rei, May 17, 1908. Haseman.

6872a-d, C. M., four, largest about 48 mm. São João del Rei, May 17, 1908. Haseman.

6874a, C. M., one, 38 mm. Penedo, March 22, 1908. Haseman.

6873a, C. M., one, 40 mm. Queimadas, Rio Itapicurú, March 2, 1908. Haseman.

6878a, C. M., one, 48 mm. Iporanga, Dec. 1, 1908. Haseman.

This species is very closely allied to *pequira*, differing in the characters noted in the key. It is almost identical in characters with *Odontostilbe microcephala*.

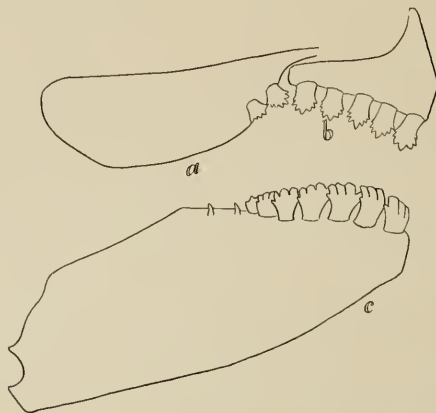


FIG. 32. *Holesthes heterodon* Eigenmann. a, maxillary; b, premaxillary; c, mandible.

Head 4.25-4.75; depth 3-3.5; D. 11, very rarely 10; A. 19-24 most frequently 20 in specimens from Jaguará and Bebedouro; most frequently 22 in specimens from Pirapora and Sete Lagoas of the San Francisco basin. Scales 5 or  $6\frac{3}{4}$ ,  $\frac{35}{5}$ ,  $\frac{36}{15}$ ,  $\frac{37}{3}$ -4 (35 being more frequent in the specimens from the San Francisco; 36 more frequent in specimens from Jaguará and Bebedouro). Eye 3 in head, equal to interorbital; depth of caudal peduncle 2.5 in the depth, 1.5-1.75 in its length.

Compressed, elongate; the dorsal and ventral profiles equally arched; pre-ventral area flat or rounded, with about thirteen scales; predorsal rounded, with

ten to twelve scales in a series which is regular, except at about the sixth scale from the occipital process; occipital process about one-sixth in the distance to the dorsal; bordered by two or three scales; frontal fontanel a little longer than wide, a little more than twice the length of the parietal; maxillary reaching to below anterior margin of eye; teeth as in *C. pequirã*, premaxillary teeth in those examined  $\frac{5-5}{5}$ ,  $\frac{6-6}{7}$ ,  $\frac{5-6}{4}$ ,  $\frac{6-7}{1}$ ; maxillary teeth ranging from one to four most frequently two and two in San Francisco specimens, most frequently three and three in Jaguarã and Bebedouro specimens; mandible with about six graduate teeth and a few minute ones on the side; third suborbital and lower postorbital leaving but a very narrow naked strip behind them. Gill-rakers 6 or 7 + 11 or 12.

Origin of dorsal about equidistant from tip of snout and the interneural of the caudal peduncle, distinctly behind the vertical, from the origin of the ventrals; origin of anal under base of last dorsal ray. Dorsal rays of male not prolonged; height of dorsal a little greater than length of head; base of anal a trifle longer than height of dorsal; the first five or six fully developed anal rays of the male broad, with hooks; the ventral profile from origin of anal to caudal concave; ventrals usually just reaching anal in male; pectorals just reaching ventrals, these fins a little shorter in the female; ventral rays of the male with some hooks below.

Scales thin, regularly imbricate with a few widely divergent radial striæ. Caudal naked; anal with a very rudimentary sheath at the base of the anterior rays.

Lateral line complete, except in one specimen from Sete Lagoas and in nine specimens from Jaguarã, in which the pores were:

| Left.              | Right.                             |
|--------------------|------------------------------------|
| 4-3-3-2-1-23       | 4-3-3-3-4-3 $\frac{11}{22}$ -1-4-8 |
| 36                 | 34-2                               |
| 10-3-1-1-1-6-12-2  | 14-5-4-3-9                         |
| 37                 | 4-2-29-2                           |
| 10-2-6-3-4-6-5-?   | 13-2-3-1-1-2-3-1-8-2               |
| 30-2-1-2-1         | 4-5-5-6-5-2-9-?                    |
| 16-2-17            | 34+ (?)                            |
| 2-21-5-3-3-2       | 7-5-7-2-15                         |
| ? (10-2-4)-2-13    | 7-3-5-4-17-1                       |
| 8-3-2-2-3-1-10-4-4 | 5-3-6-1-1-1-1-1-13-1-3             |

The heavy-faced figures indicate scales with pores. It is seen that many sorts of breaks occur. The pores may not be developed in front, at the end, or at any point along the lateral line, and at different points on the two sides.

An ovate spot at the end of the caudal peduncle, continued a little way on the middle rays; tip of dorsal variously dusky, a distinct narrow, silvery, lateral band.

Genus XXI. ODONTOSTILBE<sup>40</sup> Cope.

*Odontostilbe* Cope, Proc. Am. Phil. Soc., 1870, p. 566.

**Type:** *Odontostilbe fugitiva* Cope.

Teeth notched, in a single series, those of the premaxillary and mandible similar, with a large median point and smaller lateral points; maxillary with a few broad-tipped teeth; third suborbital in contact with the pre-opercle below; adipose fin well-developed; origin of anal under end of dorsal; caudal naked; lateral line complete; scales with few radial striæ; interhæmals feeble, not projecting.

Minute fishes found from Panama and Trinidad to the La Plata and the Peruvian Amazon.

But few of the species of this genus are distinguishable at sight. *O. melandeta* may be distinguished by the absence of a proper caudal spot; *paraguayensis* and *madeiræ* by their deep form, they are quite similar; *drepanon* by its filamentous fin-rays. *O. microcephala* and *fugitiva* are very similar. *O. hastata* stands quite alone, but looks like *microcephala*. *O. microcephala* differs from *Holesthes heterodon* largely in the structure of the teeth of the lower jaw.

It is possible that *O. hastata* and *O. melandeta* do not belong to this genus.

KEY TO THE SPECIES OF ODONTOSTILBE.

- a. Caudal in the male with a pouch covered by scales just below the shortest rays at the middle. Eye 3; A. 18-21; rays of lower caudal lobe of male with retrorse hooks, an intense well circumscribed spot on the caudal peduncle. . . . . 48. *hastata* Eigenmann.
- aa. Caudal naked in the male.
  - b. A large conspicuous caudal spot; teeth large; 5-7 in the premaxillary, 1-4 in the maxillary.
    - c. Male with the outer ventral and first developed dorsal rays filamentous. D. 10 to 12. . . . . 49. *drepanon* Fowler.
  - cc. Male without filamentous rays.
    - d. Dorsal with 10 or 11 rays.
      - e. Depth about 3.25; A. 22-34; scales 35 to 37; mouth minute, maxillary half the length of the eye. . . . . 50. *fugitiva* Cope.
      - ee. Depth 3 to 4; A. 18-22, scales 34-37; mouth moderate, maxillary more than half the length of the eye. . . . . 51. *microcephala* Eigenmann.
      - eee. Depth 2.5 to 2.75; A. 22-25; scales 33 or 34; caudal spot indistinct. . . . . 52. *pulchra* Gill.
      - eeee. Depth 2.6 to 3; A. 21-24; scales 32-35; mouth minute. Maxillary half the length of the eye. . . . . 53. *paraguayensis* Eigenmann & Kennedy.

<sup>40</sup> ὀδόντις, ὀ = tooth; στίλβη, ἦ = a lamp, possibly in allusion to the brilliant teeth.

- dd.* Dorsal with 12 or 13 rays; depth  $2\frac{1}{2}$  to 3; A. 23-24; scales 34 to 37; mouth minute; maxillary half the length of the eye.....54. *madeiræ* Fowler.  
*bb.* No distinct caudal spot; caudal peduncle narrowly margined with dark; depth 3.6; A. 21; scales 34 or 35; premaxillary with 10 to 14 teeth, maxillary with 4 to 7.....55. *melandeta* Eigenmann.

48. *Odontostilbe hastata* Eigenmann. (Plate XVI, fig. 1.)

*Odontostilbe hastatus* Eigenmann, Indiana University Studies, No. 18, 1913, p. 27.

**Range:** Magdalena and Atrato basins.

5703, C. M., type, ♂, 40 mm.; paratypes, twenty-five, largest 37 mm.

5104 a-j, C. M. 12861a-j, I. U. M., Soplaviento. Eigenmann.

5365a, C. M., Certegui. Rio Quito, into Atrato. Wilson.

5387a-f, C. M., 13079, I. U. M., many, Rio Atrato at Quibdo. Wilson.

5366a-x, C. M., 13045, I. U. M., many, Rio Truando, into Atrato. Wilson.

Head 4 +; depth 2.8-3.25; D. 11; A. most frequently 19 (18-21); scales

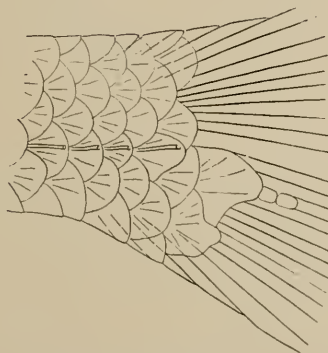


FIG. 33. *Odontostilbe hastata* Eigenmann. Caudal scales of ♂.

5.5-32 to 35-3; eye 3 in the head, equal to interorbital. Most nearly like *Odontostilbe paraguayensis*, but much slenderer.

Compressed; dorsal and ventral profiles equally arched; preventral area rounded, with about eleven scales; postventral and predorsal areas narrowly rounded, the latter with a regular median series of about ten scales; occipital process short and broad, its length one-sixth of the length from its base to the dorsal, bounded by three scales on each side; frontal fontanel variable, an equilateral triangle as wide as, and half as long as, the parietal fontanel, or quite minute; skull convex; snout blunt, the mouth comparatively large; maxillary-premaxillary nearly as long as the eye; five teeth in the premaxillary, two or three in the maxil-



lary; four broad-tipped, seven-pointed teeth in the dentary in front and with as many as four graduated teeth on the side. Second suborbital covering the entire cheek. About ten rakers on the lower arch of the gill.

Dorsal pointed, its highest ray longer than head, reaching to within two or three scales of the adipose, its origin about equidistant from tip of snout and caudal; middle caudal rays very short; a pouch on the caudal of the male just below the middle rays covered with scales; in the male the rays of the lower caudal lobe with retrorse hooks, similar to those of the five anterior anal rays in the male; anal short, its margin subtruncate (very slightly emarginate), its rays graduate, the tip of the highest (the third) reaching to last fourth or to base of the last ray; anal base 3.75-4.6 in the length, its origin behind the vertical from the last dorsal ray; origin of ventrals in front of the vertical from the anterior dorsal ray, about reaching the anal; pectorals not quite reaching ventrals or slightly beyond their base.

Scales thin, regularly imbricate, with as many as ten radial striæ; lateral line complete, nearly straight; anal sheath consisting of a single row of scales along the bases of the anterior rays; caudal naked, except for a basal sheath on the lower lobe of the male and the peculiar scales just below the middle rays in the male.

Scales of the back margined with dark; margins of the myotomes above the anal marked with chromatophores; no humeral spot; a silvery band; a conspicuous black spot on the end of the caudal peduncle, rounded in front, pointed on the bases only of the middle caudal rays; peduncle in front of the spot without chromatophores. Orange in life above and behind caudal spot.

One specimen from the Calamar Cienega, 32 mm., C. M. No. 5105, and three, the largest 30 mm., C. M. No. 5106, I. U. M., No. 12862, may belong to this species. Chromatophores are limited to the dorsal region and to along the base of the anal; the caudal spot is smaller, oval.

#### 49. *Odontostilbe drepanon* Fowler.

*Odontostilbe drepanon* Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 529. (Tributary of the Madeira river near Porto Velho.)

**Range:** Madeira basin.

This species is known from the types only. It is quite possible that it will prove to be synonymous with *O. fugitiva*.

Head 3.25; depth 3-1/6; D. 10; A. 24; scales 6-38-5; 9 predorsal scales; eye 3.25 in the length of the head, maxillary 3.5; interorbital 2.87; depth of caudal peduncle 2.66.

Elongate, well compressed; mouth small, terminal; lips moderate; maxillary not reaching eye; teeth with five to seven points, maxillary with two teeth; sub-orbital completely covering cheek. Origin of dorsal midway between tip of snout and tip of adipose; third dorsal ray prolonged and filamentous, nearly to origin of the adipose; origin of anal behind base of dorsal, third ray longest, thence gradually

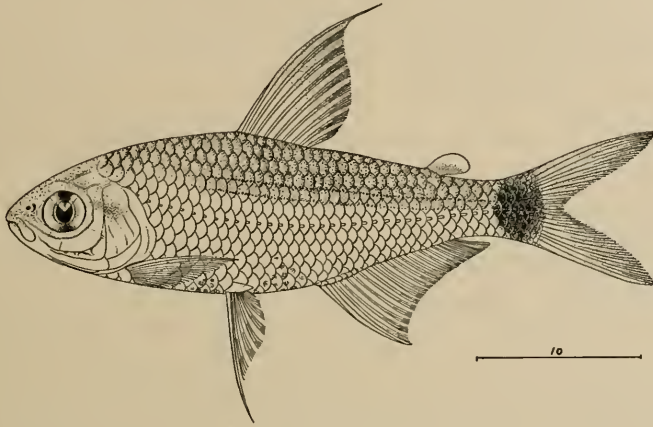


FIG. 34. *Odontostilbe drepanon* Fowler. (After Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 529.)

diminishing; pectorals reaching ventrals; origin of ventrals in front of dorsal, first ray produced in a filament, which extends beyond the origin of anal.

Base of caudal with a dusky blotch a little larger than the eye, not continued to the end of the middle rays. No humeral spot. Fins all pale.

#### 50. *Odontostilbe fugitiva* Cope.

*Odontostilbe fugitiva* Cope, Proc. Am. Philos. Soc., 1870, p. 566, fig. (Pebas); Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429. *Cheirodon fugitiva* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290. (Lower Amazon.)

**Range:** Amazon basin.

6863a-d, C. M., four, largest 41 mm. San Antonio de Rio Madeira. Nov. 3, 1909. Haseman.

Head 4.5; depth 3.25-3; D. 11; A. 22 or 23; scales 37. Eye 2.75-3 in the head, .6 in snout, equals interorbital; depth of caudal peduncle 3 in the depth, 1.4 in its own length. Gill-rakers 7 + 12.

51. *Odontostilbe microcephala* Eigenmann.

*Odontostilbe microcephalus* Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 10.

Range: Paraguay and Upper Paraná basins.

11086, I. U. M., type, 46 mm. 11086, I. U. M., paratype, 45 mm. Rio Pilcomayo, Bolivia. Exchange with British Museum.

6854a-c, C. M., five, largest about 80 mm. (the caudal is broken), the longest on record for the genus. Rio Tieté at Salto Avandava below the falls. Sept. 15, 1908. Haseman.

6855a-p, C. M., sixteen, largest 33 mm. Rio Tieté, Salto Avandava above the falls. Sept. 14, 1908. Haseman.

6856a, C. M., one, 38 mm. Asunción. March 28, 1909. Haseman.

Readily distinguished from the other members of the genus by the teeth, by the elongate form and prominent caudal spot.

Head 4-4.6; depth 3-4; D. usually 11, rarely 10; A.  $\frac{18}{11}$ ,  $\frac{20}{11}$ ,  $\frac{21}{11}$ ,  $\frac{22}{11}$ ; scales

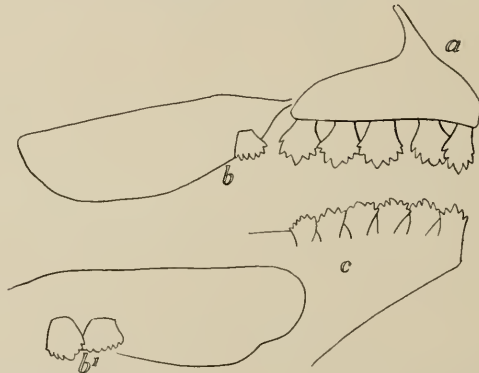


FIG. 35. *Odontostilbe microcephala* Eigenmann. a, premaxillary; b, maxillary; b<sup>1</sup> left maxillary of another individual; c, mandible. (All figures greatly enlarged).

$6-\frac{3.1}{2}, \frac{3.5}{2}, \frac{3.6}{3}, \frac{3.7}{1}-4$  or 5; eye 2.5-3 in the head, equal to or a little greater than the interorbital, .6-.9 (in largest) in the snout; depth of the caudal peduncle 2.33-3 in the depth, .4 of its own length.

Elongate; dorsal and ventral profiles similar; preventral area flat, with a regular median series of fifteen scales; predorsal area rounded, with a median series of eleven scales. Occipital process one-fifth to one-eighth in the distance to the dorsal; frontal fontanel about 2.5 in the parietal; second suborbital and the

postorbitals leaving a very narrow naked area between them and the upper limb of the preopercle. Snout pointed, maxillary scarcely reaching to origin of eye, its length about .6 or .7 that of the eye; usually two maxillary teeth, rarely one or three; premaxillary and mandibular teeth similar, their margins rounded, the median cusp slightly the larger, five, very rarely six, teeth in the premaxillary; mandibular teeth eight to ten; the premaxillary teeth slightly directed backward, the teeth in the largest specimen (6854a) are much broader, more symmetrical, and the differences between the points are very slight, the smallest specimen, from the same locality has fewer points and the median point is distinctly more prominent. Gill rakers 7 + 10.

Origin of dorsal a little nearer end of adipose than to tip of snout; highest dorsal ray equals length of head; adipose fin well-developed; origin of anal below tip or middle of last dorsal ray, the fin emarginate, its base equalling length of head or a little more; tip of ventrals to the anal or to the third scale in front of it; origin of ventrals under, or slightly in advance of, the origin of the dorsal; the pectorals to the ventrals, or to the third scale in front of them.

Scales thin, regularly imbricate; lateral line but little decurved; caudal naked; anal with a few scales forming a sheath in front.

A silvery lateral band ending in a large, oval spot on the caudal peduncle, which extends a little upon the middle caudal rays and sometimes entirely across the end of the peduncle.

52. *Odontostilbe pulchra* (Gill.) (Plate XVII, fig. 1.)

*Poecilurichthys pulcher* Gill, Ann. Lyc. Nat. Hist., Vol. VI, 1858, p. 59 (Trinidad).

*Cheirodon (Odontostilbe) pulcher* Lütken, Overs. Dan. Selsk., 1874, p. 236.

*Odontostilbe pulcher* Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

*Cheirodon pulcher* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290.

*Chirodon pulcher* Regan, Proc. Zool. Soc. London, 1906, p. 385 (Trinidad).

Range: Trinidad.

As far as known this species is confined to the Island of Trinidad. I have seen no specimens.

The following description is compiled from Regan's account:

Head 4.5-4.66; depth 2.5-2.75; D. 11; A. 23-25; scales 5.5-32 to 34-3.5-4.5, 4.5-5.5 between lateral line and anal. Snout 5 in the head, eye 2.5, interorbital 2.25.

Maxillary extending to the vertical from the anterior margin of eye. Origin of dorsal equidistant from snout and base of caudal, its height greater than head.

Pectorals extending to ventrals, origin of ventrals in advance of dorsal, extending nearly to the anal. Caudal peduncle as long as deep.

Olivaceous, sides silvery, or a silvery longitudinal stripe from operculum to base of caudal; an indistinct dark humeral spot; a blackish spot at the base of caudal, ending posteriorly in a point and margined with yellow above and below; dorsal and anal pink.

53. *Odontostilbe paraguayensis* Eigenmann & Kennedy. (Plate XVI, fig. 2; plate XVII, fig. 3.)

*Odontostilbe paraguayensis* Eigenmann & Kennedy, Proc. Acad. Sci. Phila., 1903, p. 512 (Asunción; Arroyo Trementina); Eigenmann, Ann. Carnegie Museum, Vol. IV, 1907, p. 125 (Corumbá); Reports Princeton Univ. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin.

9988, I. U. M., type, 40 mm. Asunción. J. D. Anisits.

10111, I. U. M., three, 40 mm. Arroyo Trementina. J. D. Anisits.

10178, I. U. M., five, Corumbá. J. D. Anisits.

6853a-m, C. M., fourteen, 22-39 mm. Asunción, March 29, 1909. J. D. Haseman.

This is the deepest of the species of *Odontostilbe*, greatly differing from the type, *O. fugitiva*, in depth.

Head 3.75-4.5; depth adult female 2.6, adult male 3; D. 11; A. 21-24; scales 6-32 to 35-4; eye 2.66-3 in head, about equal to interorbital; depth of caudal peduncle 2.66-3.25 in the greatest depth.

Compressed; dorsal and ventral profiles about equally curved, the depth increasing rapidly to the origin of dorsal and tapering to the slender caudal peduncle; preventral area flat, with well marked lateral angles, with a perfect median series of eleven to thirteen scales, or but one scale disarranged; predorsal area keeled with about nine scales; occipital process pointed, reaching about one-fourth to the dorsal; skull smooth, convex, frontal fontanel a nearly equilateral triangle about one-third as long as the parietal fontanel without the groove; third suborbital leaving naked only a small wedge of the cheek behind its upper angle; postorbitals very thin, leaving this area practically naked; mouth small, maxillary reaching to, or not quite reaching, the vertical from the anterior margin of the eye, about half as long as eye; premaxillary with five or six sub-ovate teeth, each with a



prominent median cusp and four, rarely five, more or less graduate cusps on each side, the two edges of the teeth not quite symmetric; maxillary with two or three broad teeth; mandible with eight graduate teeth, the anterior ones very wide at the tip, contracted at the base, with a prominent median point and three or four slightly graduate points on each side of it, the tips of the lateral points forming a slight curve beyond which the median point projects somewhat, the median cusp at least twice as wide as the two cusps on either side of it; the edges of the teeth overlapping more and more toward the sides of the jaw. Gill-rakers 6 + 10.

Origin of dorsal about equidistant from tip of snout and tip of adipose, its height equal to the length of the head; adipose well-developed; caudal lobe a little longer than head; origin of anal about under vertical from tip of last dorsal ray, its margin nearly straight from the ninth ray, its base about equal to the head. Origin of ventrals about equidistant from snout, with the origin of the dorsal just reaching anal, or falling short of it by one scale; pectorals not quite reaching ventrals.

Lateral line nearly straight; scales everywhere regularly imbricate; caudal naked; anal with a few scales at the base of the anterior lobe; about six feeble interhæmals; caudal in male without hooks or special scales.

A silvery lateral band; a conspicuous caudal spot, not continued to the middle of the central caudal rays; anterior margin of dorsal membrane dark.

54. *Odontostilbe madeiræ* Fowler.

*Odontostilbe madeiræ* Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 527 (tributary of the Rio Madeira near Porto Velho).

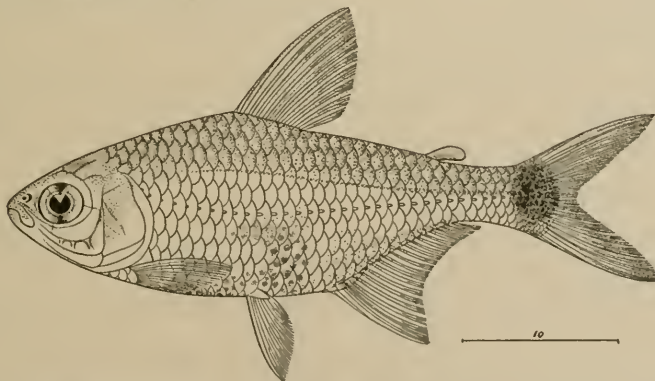


FIG. 36. *Odontostilbe madeiræ* Fowler. (After Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 527.)

**Range:** Madeira basin.

This species is known from the types only. It may be synonymous with *O. paraguayensis*.

Head 3.6; depth 2-7/8; D. 12; A. 23; scales 6-37-4; 11 predorsal scales; eye 3-1/8 in the head, maxillary 3-1/8, interorbital 3; height of dorsal 1; height of anal 1.4; depth of caudal peduncle 2.5; pectoral 1.25; ventral 1.4.

Compressed, elongately ovoid; mouth short, jaws thin; lips thin; maxillary reaching the eye; teeth broad, with seven denticles, of which the median largest; maxillary with two similar teeth; suborbitals entirely covering cheek.

Dorsal inserted nearly midway between tip of snout and end of adipose; origin of anal close behind vertical from end of dorsal, lowest edge of anal emarginate; ventrals inserted slightly behind origin of dorsal, extending to anal.

Margin of scales of back dusted, a patch of dusky dots above base of anal. Base of caudal with a large rounded spot about as large as eye. A dark line concurrent with vertebral axis from behind shoulder to caudal.

55. *Odontostilbe melandeta* Eigenmann.

*Odontostilbe melandetus* Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 312, Plate XLIV, fig. 3 (British Guiana, probably Rockstone on the Essequibo river).

Range: British Guiana.

1878, C. M., type, 27 mm.; 12160, I. U. M., two, paratypes, 27 and 35 mm.

British Guiana. Eigenmann.

Known only from the types. This species is more cylindrical, its scales firmer, its teeth smaller. It is quite possible that it represents the type of a distinct genus.

Head 3.75; depth 3.6; D. 10; A. 21; scales 4-34 or 35-3. Eye 2.5-2.7 in the head, interorbital but little narrower than the eye.

Minute, compressed, head bluntish, mouth terminal; a median series of ten scales in front of the dorsal. Maxillary very slender, reaching to below the eye; maxillary-premaxillary border as long as the eye; ten to fourteen teeth on the premaxillary, four to seven on the maxillary.

Scales very regularly imbricate, with concentric, but without longitudinal striae; lateral line complete, scarcely decurved; anal naked; base of caudal with a few scales.

Gills well-developed; anal deeply emarginate; pectorals not quite reaching ventrals, ventrals not reaching anal.

No chromatophores on the sides; scales of the back with marginal series of chromatophores; a series of black specks along the base of anal; caudal peduncle margined with black.

## APPENDIX.

Since the foregoing pages were sent to press the author has discovered among the material collected by Mr. Henn during his explorations in Ecuador an additional species, a description of which follows:

56. *Megalamphodus ecuadorensis* sp. nov.

13628, I. U. M. Type, about 28 mm., 20.5 mm. to base of caudal. Naranjito, Rio Chan Chan, Ecuador. Henn.

Of this species, the only one of the subfamily found on the Pacific slope of the northern half of South America, I have but a single, poorly preserved specimen. Head 3.4; depth about 3; D. ?; A. 23; Scales ?; eye 3 in the head, a little greater than the interorbital.

Compressed; dorsal and ventral outlines equally curved. Fontanels very large, the frontal fontanel entirely separating the frontal bones; third suborbital ~~having~~ <sup>leaving</sup> ~~ERRATA~~ only a narrow naked <sup>wedge</sup> ~~ridge~~ behind it. Mouth large, the maxillary-premaxillary border longer than the eye. Seven or eight premaxillary teeth, which are slightly graduate; maxillary with two small teeth (on one side at least); mandible with about fifteen teeth, of which the first four or five are nearly equal in size, larger than the premaxillary teeth, the rest rapidly diminishing in size. Origin of the dorsal a little behind the middle, 12 mm. from the tip of the snout, 10.5 mm. from the base of the middle caudal rays; origin of anal on vertical from origin of dorsal; height of dorsal very nearly equal to length of head; pectorals extending beyond the base of ventrals, ventrals beyond origin of the anal. The scales are ~~small~~ <sup>A</sup> ~~mostly lost~~ <sup>ERRATA</sup> well-defined, vertical humeral spot; margin of anal dark. <sup>nodorsal spot</sup> <sup>ERRATA</sup>

*Mimagoniates* Regan, Ann. & Mag. Nat. Hist., (7), XX, 1907, p. 402.

This genus is related to *Prionobrama* but lacks maxillary teeth and the anal is but slightly emarginate. The original description by Regan follows.

"Body strongly elongate, compressed; abdomen keeled, but not strongly compressed to an edge. Mouth small; teeth tricuspid, in a single series; ~~no maxillary teeth~~: palate toothless. Nostrils close together. Gill-membranes not united, free from the isthmus. Scales cycloid, of moderate size; lateral line incomplete. Dorsal fin short, posterior in position; adipose fin present; anal fin elongate.

"Intermediate between *Chirodon*, Girard, and *Leptagoniates*, Blgr."

*Mimagoniates* Barberi Regan.

"Depth of body 3-3.66 in the length, length of head 4-4.4. Snout much shorter than eye, the diameter of which is 2.5-2.75 in the length of the head and a little less than the interorbital width. Cleft of mouth nearly vertical; maxillary not extending to below the eye. 42-45 scales in a longitudinal series; lateral line

on 4-8 scales only. Dorsal 10; origin equidistant from gill-opening and base of caudal, above the anterior part of the anal. Anal 34-38; origin equidistant from anterior part of eye and base of caudal; anterior rays the longest, about .6 the length of head; *free edge straight or slightly concave*. Pectoral extending to or a little beyond the base of ventral. Caudal forked. A lateral band (blackish in preserved specimens) from the lower part of eye to the lower lobe of caudal. An oblique dark stripe on the dorsal; anal with a dark margin.

"Habitat, Arroyo Yâcá, Estación Cabellero, Paraguay.

"Several specimens, the largest 40 mm. in total length, collected by Dr. A. Barbero."

*Chirodon arnoldi* Boulenger, Ann. and Mag. Nat. Hist. (6), *Chirodon arnoldi* Boulenger, Ann. and Mag. Nat. Hist. (8), IV, p. 497.

This species described as a *Cheirodon* is probably a *Hemigrammus*. If it is a *Cheirodon* and if it comes from the northern part of the Isthmus of Tehuantepec, it extends the known range of the genus *Cheirodon* northward for more than ten degrees latitude.

Head 4; depth 3. D. II. 9; A. III. 19; scales 32, 4 or 5 with pores, 11 scales in a transverse series.

Strongly compressed, snout shorter than eye, eye 2.66 in head, equals inter-orbital; maxillary not reaching anterior border of eye; lower jaw scarcely projecting. Origin of dorsal just behind base of ventrals, equidistant from snout and caudal longest ray of dorsal as long as head.

Yellowish above, finely speckled with black, silvery white beneath; a large round black spot on caudal peduncle, extending on base of middle rays of caudal; dorsal, ventrals, and caudal tinged with orange.

Length 33 mm. Said to have been imported by the Aquarist Arnold of Hamburg from Puerto Mexico, on the north coast of the Isthmus of Tehuantepec.



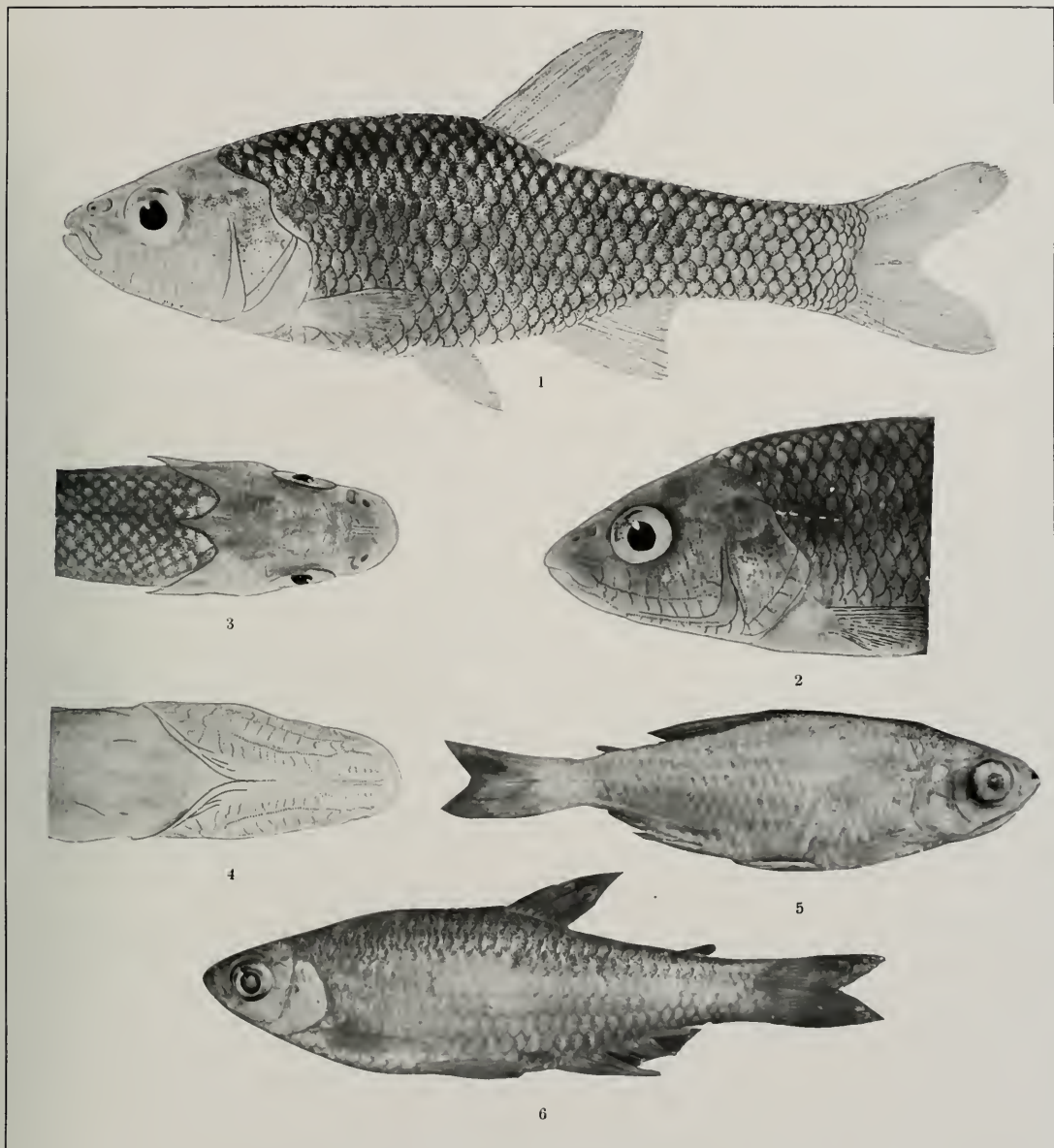


FIG. 1. *Grundulus bogotensis* (HUMBOLDT). 5084, C. M., 76 mm. Vicinity of Bogotá.

FIG. 2. *Aphyocharax paraguayensis* EIGENMANN. Type. 6096, C. M., 25 mm. Cáceres.







- FIG. 1. *Spintherobolus papilliferus* EIGENMANN. Type. 3882, C. M., 41 mm. Alto da Serra.  
 FIG. 2. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.  
 FIG. 3. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.  
 FIG. 4. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.  
 FIG. 5. *Aphyocharax rathbuni* EIGENMANN. (Type of *A. stramineus* Eigenmann.) 10030, I. U. M. 25 mm. to base of caudal. Arroyo Trementina.  
 FIG. 6. *Aphyocharax anisitsi* EIGENMANN & KENNEDY. Type. 10028, I. U. M., 41 mm. Asunción.



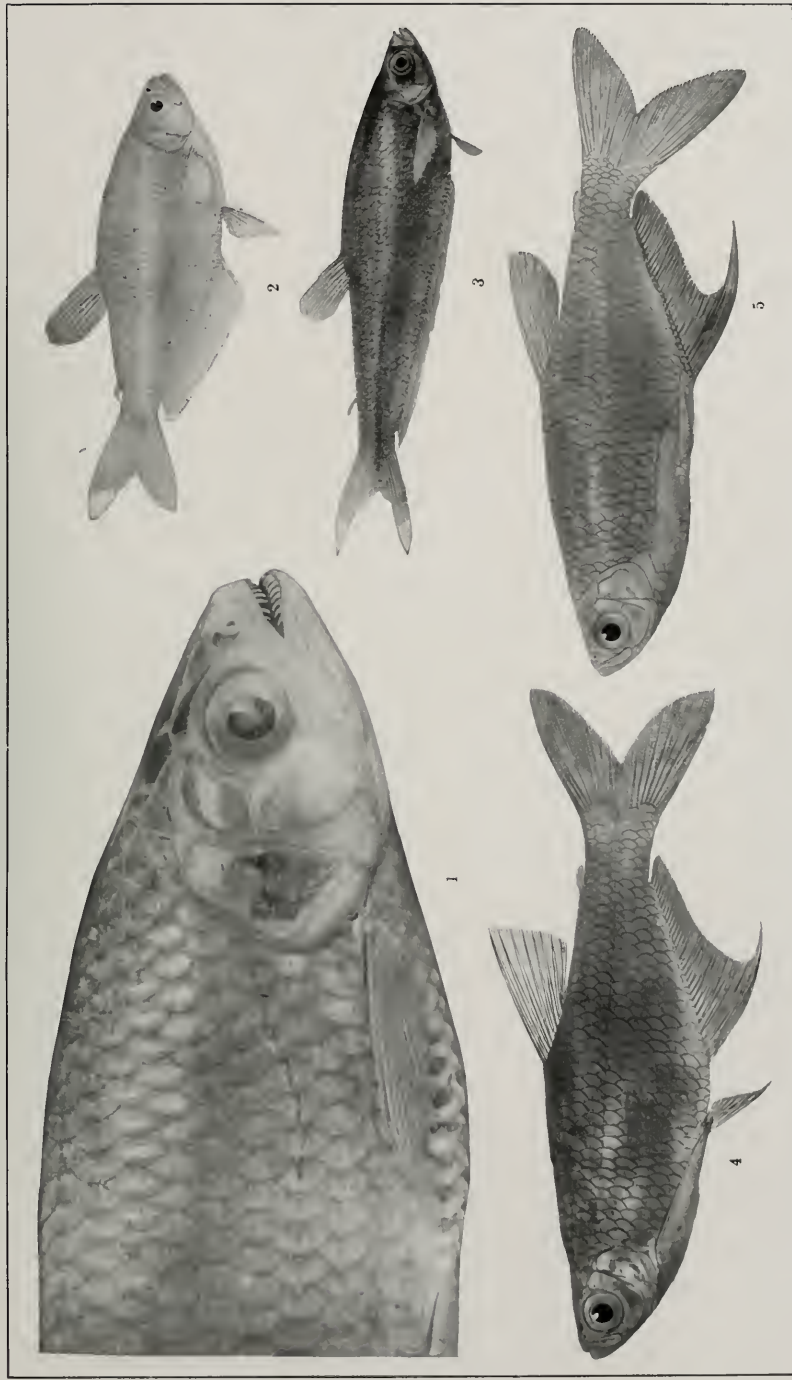


FIG. 1. *Aphyocharax dentatus* EIGENMANN & KENNEDY. Type, 10032, I. U. M., 71 mm. Asunción.

FIG. 2. *Paragoniates alburnus* STEINDACHNER. (After Steindachner.) 77 mm.

FIG. 3. *Leptagoniates steindachneri* Boulenger. (After Boulenger.) 95 mm.

FIG. 4. *Prionobrama filigerus* (Cope). 5497, C. M., 54 mm. Santarem.

FIG. 5. *Prionobrama paraguayensis* (Eigenmann). 5499, C. M. Corumbá.







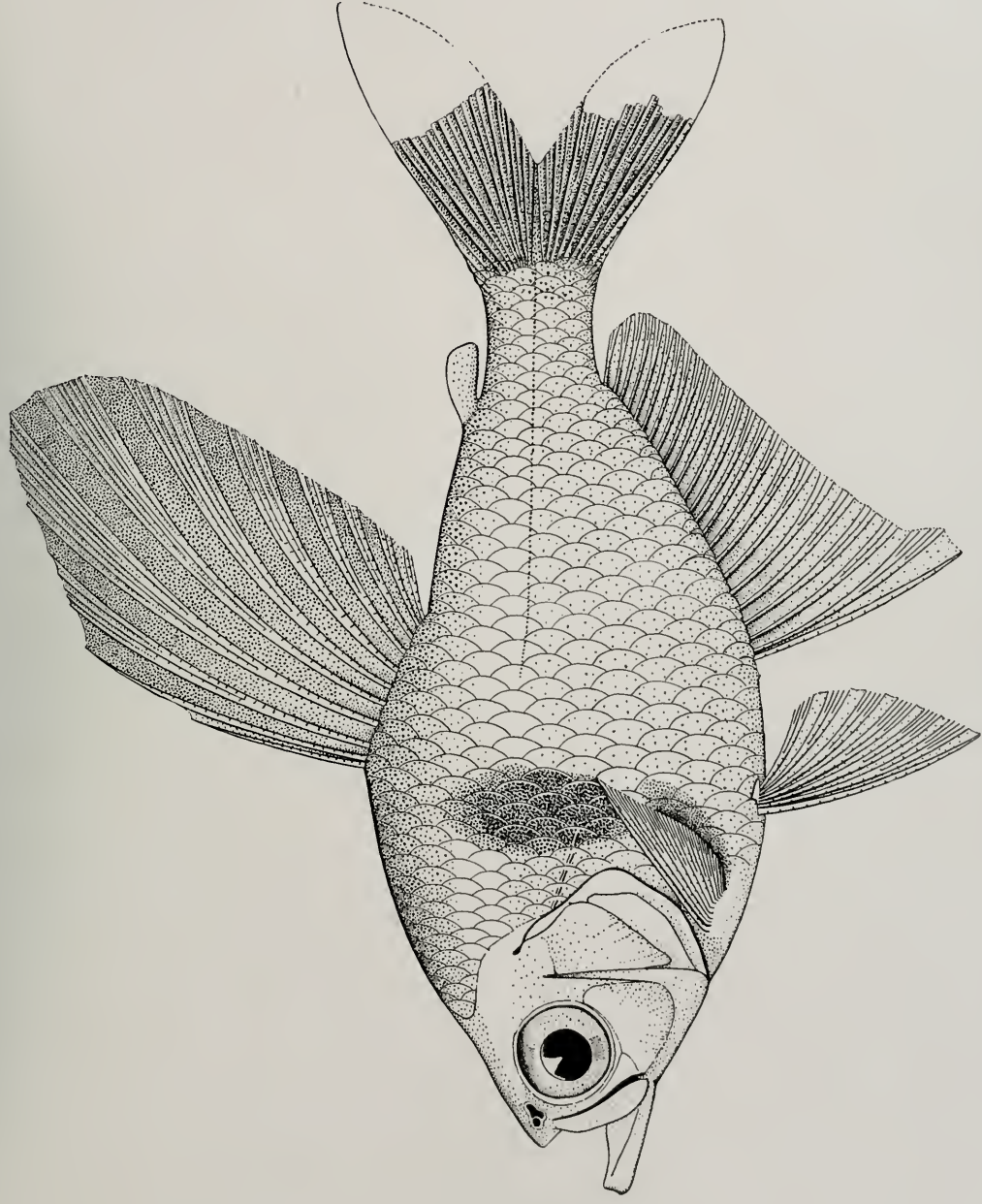
**ERRATA** *macrolepis* Meek & Hildebrand  
 FIG. 1. *Phanagoniates* ~~macrolepis~~ EIGENMANN. Type. 5354, C. M., 41 mm. Manigru.  
 FIG. 2. *Parcebasis cyclolepis* EIGENMANN. Type. 5495, C. M., 74 mm. San Antonio de Rio Madeira.





FIG. 1. *Leptobrycon jatuarana* EIGENMANN. Type. 20952, M. C. Z., 29 mm. to base of caudal. Jatuarana.  
FIG. 2. *Macropsobrycon uruguayana* EIGENMANN. Type. 6895, C. M., 46 mm. Caequy.





*Megalampodus megalopterus* EIGENMANN. Type. 6806, C. M., 35 mm. Caceres.







FIG. 1. *Megalamphodus micropterus* EIGENMANN. Type. 6900, C. M., 30 mm. Lagoa do Porto, Basin Rio S. Francisco.  
FIG. 2. *Microchemobrycon guaporensis* EIGENMANN. Type. 6910, C. M., about 37 mm. Maciél.





FIG. 1. *Oligobrycon microstomus* EIGENMANN. Type. 6898, C. M., 39 mm. Jacarehy, Rio S. Francisco.

FIG. 2. *Aphyocheirodon hemigrammus* EIGENMANN. Type. 6802, C. M., 45 mm. Jaguara.

EMATA







FIG. 1. *Compsura heterura* EIGENMANN. Type, ♂. 6808, C. M., 36 mm. Queimadas Rio Itapicurufrú.

FIG. 2. *Mixobrycon ribeiroi* EIGENMANN. Type. 10229, I. U. M., 35 mm. to base of caudal. Puerto Max, Paraguay.

ERRATA



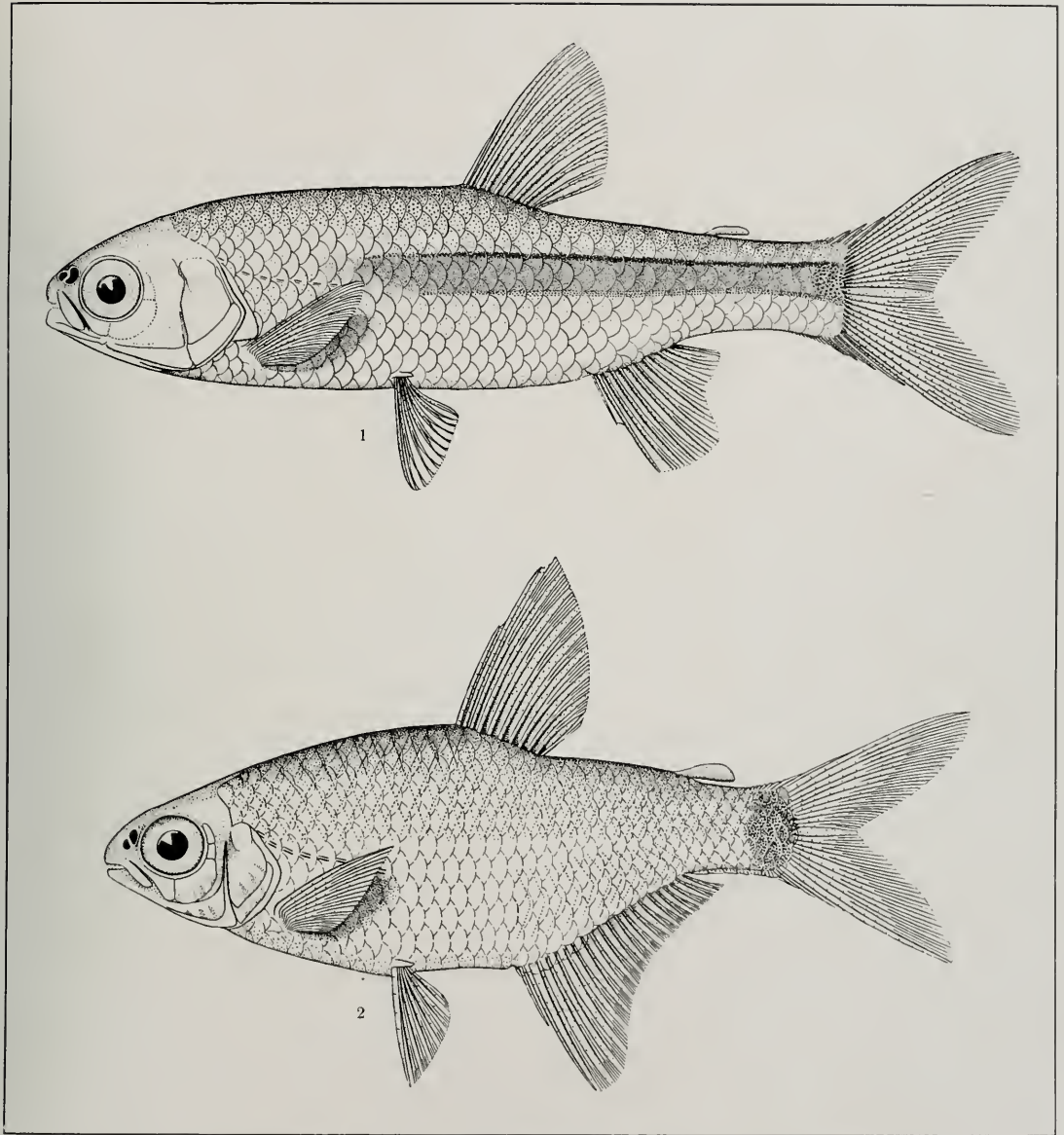


FIG. 1. *Cheirodon annae* MCATEE. 4301, I. U. M., 41 mm. S. America. Exact locality unknown.  
FIG. 2. *Cheirodon parahyba* EIGENMANN. Type. 6841, C. M., 38 mm. Campos, on R. Parahyba.





FIG. 1. *Cheirodon interruptus* JENYNS, ♀. 6818, C. M., 44 mm. Cachocira, R. Jacuhy, R. Grande do Sul.

FIG. 2. *Cheirodon notomelas* EIGENMANN. Type, ♀. 6812, C. M., 35 mm. Miguel Calmone.







FIG. 1. *Cheirodon madeira* EIGENMANN. Type. 6847, C. M., 32 mm. San Joaquin.  
FIG. 2. *Cheirodon piaba* LÜTKEN, ♂. 6822, C. M., 40 mm. Corumbá.





FIG. 1. *Cheirodon microdon* EIGENMANN. Type, ♀. 6850, C. M., 42 mm. Caacres.  
FIG. 2. *Cheirodon stenodon* EIGENMANN. Type. 6848, C. M., 33 mm. Bebedouro.







FIG. 1. *Holesthes pequira* (Steindachner). 6857, C. M., 44 mm. Villa Hays.

FIG. 2. *Holesthes heterodon* EIGENMANN. Paratype. 6876, C. M., about 46 mm. Jaguará.





FIG. 1. *Odontostilbe hastata* EIGENMANN. 5366, C. M., 30 mm. Rio Truando, Colombia.

FIG. 2. *Odontostilbe paraguayensis* EIGENMANN & KENNEDY. 6853, C. M., 36 mm. Asunción.





FIG. 1. *Odontostilbe pulchra* (Gill). (After Regan.)

FIG. 2. *Cheirodon insignis* STEINDACHNER. (After Steindachner.)

FIG. 3. *Odontostilbe paraguayensis* EIGENMANN & KENNEDY. 10178, I. U. M.

FIG. 4. *Cheirodon pisciculus* GIRARD. (After Girard.)

FIG. 5. *Cheirodon piaba* LÜTKEN. (After Lütken.)

FIG. 6. *Cheirodon piaba* LÜTKEN. 10121, I. U. M. (Greatly enlarged to show the pseudotympanum.)



